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OFFICE OF WATER RESEARCH AND TECHNOLOGY

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VOLUME 13, NUMBER 8
APRIL 15, 1980

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SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the
Office of Water Research and Technology
U.S. Department of the Interior

VOLUME 13, NUMBER 8
APRIL 15, 1980

W80-02701 -- W80-03000

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most our our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographic citation and a set of identifiers or descriptors which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Office of Water Research and Technology.

To provide SWRA with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

The input from these Centers, and from the 54 Water Resources Research Institutes administered under the Water Research and Development Act of 1978, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies becomes the information base from which this journal is derived.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

THE EFFECT OF THE ANAESTHETIC BENZOCAINE HYDROCHLORIDE ON FRESHWATER QUALITY,
Randse Afrikaanse Univ., Johannesburg (South Africa). Navorsingsgroep vir Varswaterbiologie.
J. T. Ferreira, G. L. Smit, and H. J. Schoonbee.
Water S. A., Vol 5, No 3, p 123-127, July 1979. 1 Fig, 4 Tab, 9 Ref.

Descriptors: *Freshwater fish, *Water properties, *Fish physiology, Fish handling facilities, Chemical properties, Water chemistry, Volumetric analysis, Boreholes, Distillation, Sodium compounds, Hardness(Water), Alkalinity, Calcium, Tapwater, Anaesthetics, Benzocaine hydrochloride.

Benzocaine hydrochloride, a commonly used fish anaesthetic, produces chemical and physical changes in freshwater. Because fish haematology is often used for health measurements, any changes in water parameters that may be reflected in fish haematology are of significance. Benzocaine hydrochloride was added to samples of tapwater, boreholewater, and distilled water in concentrations of 50, 80, and 100 mg/cubic decimeter. Water quality parameters measured were pH, p02, pC02, conductivity, alkalinity, and calcium hardness. Values were taken after 5, 30, 60, 90, and 240 minutes. Benzocaine hydrochloride neutralized with sodium hydroxide was also tested. Results show that the benzocaine hydrochloride caused drastic changes for the tested parameters in tapwater and boreholewater, while distilled water showed only conductivity changes. Water pC02 values for tapwater and boreholewater increased with increasing benzocaine hydrochloride concentrations and with time. Tapwater also had the highest calcium hardness. The benzocaine hydrochloride neutralized with sodium hydrochloride tests showed that no changes occurred in any water quality parameters except for an increase in conductivity in distilled water. (Seigler-IPA)
W80-02752

MICROCOMPUTER COMPATIBLE METHOD OF RESOLVING RATE CONSTANTS IN MIXED FIRST- AND SECOND-ORDER KINETIC RATE LAWS,
Nebraska Univ., Lincoln. Dept. of Chemistry.
P. B. Kelter, and J. D. Carr.
Analytical Chemistry, Vol 51, p 1828-1834, September 1979. 1 Fig, 6 Tab, 7 Ref, 2 Append.

Descriptors: *Chemical reactions, *Kinetics, *Rates, *Mathematical models, Model studies, Theoretical analysis, Oxidation, Computer models, Simulation analysis, Optimization.

A fast reliable method of kinetic data treatment for systems having first-order and second-order reactions occurring in parallel is developed. The method, an extention of a R. G. Cornell technique, can also be applied to mixed-order systems. It is designed for use on a microcomputer or programmable calculator. Absorbance versus time data is used to calculate the rate constants at zero time. Reaction values from both simulated and real data are determined. Fo the simulated data both noiseless and noisy data is used to cover a broad range of conditions. The simulated data is also used to illustrate method limitations and to suggest methods of data collection optimization. Reaction values are presented from the oxidation of aqueous formic acid by ferrate (VI) ion under pseudo-first-order conditions. Results obtained from application of the method are compared with those from standard methods such as graphical means and Fletcher-Powell minimization. The comparison shows good agreement for the values. (Seigler-IPA)
W80-02759

THE WATERS OF HOT SPRINGS NATIONAL PARK, ARKANSAS--THEIR NATURE AND ORIGIN,
Geological Survey, Lakewood, CO. Water Resources Div.; and Geological Survey, Reston, VA. Water Resources Div.; and Geological Survey, Little Rock, AR. Water Resources Div.
M. S. Bedinger, F. J. Pearson Jr., J. E. Reed, R. T. Sniegocki, and C. G. Stone.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $2.00 Geological Survey Professional Paper 1044-C, 1979. 33 p, 13 Fig, 1 Plate, 11 Tab.

Descriptors: *Geothermal studies, *Thermal springs, *Water temperature, *Hydrogeology, *Water chemistry, Groundwater movement, Radioactive dating, Groundwater recharge, Water quality, Dissolved solids, Silica, Model studies, Flow system, Evaluation, Arkansas, *Hot Springs National Park(Ark).

The hot springs of Hot Springs National Park, Arkansas, issue from the Hot Springs Sandstone Member of the Stanley Shale of Mississippian age at the crest of a plunging overturned anticline, along the southern margin of the Ouachita anticlinorium. The combined flow of the 47 hot springs ranges from 750,000 to 950,000 gallons per day. The temperature of the combined hot-springs water is about 62 Celsius. The maximum temperature of the water at depth is estimated to be not more than a few degrees Celsius higher than the temperature at the surface. Maximum temperature measurements since 1804 indicate a small decline in temperature with time. Tritium and Carbon-14 analyses of the water indicate that the water is a mixture of a very small amount of water less than 20 years old and a preponderance of water about 4,400 years old. The dissolved solids concentrations range from 175 to 200 milligrams per liter. The main differences in the quality of the hot water, compared with the nearby cold ground water, are the high temperature and higher silica concentrations of the hot springs. Mathematical models were employed to test various conceptual models of the hot-springs flow system. (Woodard-USGS)
W80-02929

1B. Aqueous Solutions and Suspensions

ADSORPTION OF LEAD FROM SOLUTION ON THE QUARTZ- AND FELDSPAR-CONTAINING SILT FRACTION OF A NATURAL STREAMBED SEDIMENT,
Geological Survey, Menlo Park, CA. Water Resources Div.
D. W. Brown.
In: Chemical Modeling in Aqueous Systems, Speciation ACS Symposium Series 93: American Chemical Society, Washington, District of Columbia, p 238-260, 1979. 10 Fig, 1 Tab, 16 Ref.

Descriptors: *Model studies, *Lead, *Adsorption, *Streambeds, *Bottom sediments, Water chemistry, Chemical reactions, Cation exchange, Sorption, Surface, *Lead adsorption, Electrical double-layer, Surface charge, Surface potential.

The extensive use of lead antiknock additives in gasoline has made lead perhaps the most widely distributed toxic heavy metal in the urban environment and has greatly increased its availability for solution in natural waters. In a natural water system the chemical processes that can greatly vary the concentration of lead are those of complex formation, solution-precipitation, and adsorption. This paper presents a comprehensive method for evaluating the surface characteristics needed to predict the adsorption behavior of lead on the silt fraction of sediments from a natural streambed. Also presented is a quantitative description of lead adsorption on such material primarily as a function of pH between 4 and 8, the range most commonly encountered in natural waters. (Woodard-USGS)
W80-02918

2. WATER CYCLE

2A. General

MICROBIOLOGICAL STUDY OF STORM RUNOFF WATERS FROM A 100% RESIDENTIAL AREA IN CANADA,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5B.
W80-02728

BIBLIOGRAPHY OF WATER QUALITY BRANCH PUBLICATIONS 1978.
Department of the Environment Ottawa (Ontario). Water Quality Branch.
Ottawa, Ontario, Canada 1979, English and French. 15 p, 1 App.

Descriptors: *Bibliographies, *Water quality, Aquatic habitats, Data storage and retrieval, Monitoring, Sampling, Sediments, Precipitation, Canada.

This bibliography lists studies carried out by the Water Quality Branch in 1978. Titles of reports plus a brief abstract and a contact person for further information are included. (WATDOC)
W80-02834

ANALYSIS AND USE OF URBAN RAINFALL DATA IN CANADA.
Howard (Charles) and Associates Ltd., Ottawa (Ontario).
Available from Environmental Protection Service, Environment Canada, Ottawa, Ontario, Canada, K1A 1C8. Economic and Technical Review Report EPS 3-WP-79-4, July 1979, 35 p, 8 Fig, 11 Tab, 1 App.

Descriptors: *Rainfall, *Storm water, *Urban runoff, *Statistics, Moisture deficit, Analytical techniques, Data collections, Probability, Toronto, Ontario.

Rainfall data available for 35 Canadian urban centres were analysed and are summarized in this report. This information has been assembled as a guide to engineers involved in the design of urban runoff and pollution control facilities. The results of the rainfall storm event analyses consist of yearly tables summarizing each rainfall event, and statistical tables for four rainfall storm event characteristics: storm depth (total volume); storm duration (length of event); average storm intensity (depth divided by duration), and storm inter-event time (the length of time without rain preceding the event). Statistical tables of moisture deficit estimates are also given. The table summarizing rainfall events provides a quick reference for the design engineer in choosing either specific events, series of events or years of data for design studies. The statistical tables provide information for the calculation of the probability and return period for specific storm events. The calculation of accurate probability and return periods depends on an understanding of the physical system and the important characteristics of a particular rainfall event. In many practical design situations, the joint probability of two or more rainfall event characteristics is required to accurately calculate the return period. The significance of the independence of rainfall event characteristics in these calculations is presented as an appendix to this report. (WATDOC)
W80-02839

HYDROGEOLOGY OF GLACIAL-TERRAIN LAKES, WITH MANAGEMENT AND PLANNING APPLICATIONS,
Wisconsin Univ., Madison. Dept. of Urban and Regional Planning.
S. M. Born, S. A. Smith, and D. A. Stephenson.
Journal of Hydrology, Vol 43, No 1/4, p 7-43, October 1979. 8 Fig, 4 Tab, 102 Ref, 1 Append.

Descriptors: *Surface-groundwater relationships, *Lakes, *Hydrogeology, *Groundwater, *Planning, *Hydrologic budget, Glaciation, Ground-

water movement, Water levels, Water balance, Flow system, Regime, Water table, Classification, Groundwater recharge, Kettle lakes, System efficiency, Flow through, Lake flushing rates.

The subject of the relationship between groundwater and lakes is characterized by sparse information and, in general, has received limited attention by hydrologists. Nevertheless, the hydrogeologic regime of lakes must be adequately assessed in order to intelligently manage lakes and their related shorelands. This paper was a compilation of hydrogeologic data for numerous lakes in North America and presented a preliminary classification leads to systematic categorization of lake types for planning and management purposes. The main hydrogeologic factors for assessing lake environments are: (1) regime dominance, the relative magnitude of groundwater in the total water budget of a lake; (2) system efficiency, a description of the rate aspects of surface and groundwater movement through a lake system; and (3) position within a groundwater flow system. The significance and difficulty of measuring these descriptive characteristics were indicated, and examples of each category were provided. Additionally, a variety of lake-related activities that illustrate the value of hydrogeologic information for planning and management purposes was presented. (Visocky-ISWS)
W80-02895

PHOSPHORUS INPUTS INTO A STREAM DRAINING AN AGRICULTURAL WATERSHED, II: AMOUNTS CONTRIBUTED AND RELATIVE SIGNIFICANCE OF RUNOFF TYPES,
Massey Univ., Palmerston North (New Zealand). Dept. of Soil Science.
For primary bibliographic entry see Field 5B.
W80-02900

2B. Precipitation

THE ECONOMIC EFFECTS OF WEATHER MODIFICATION ACTIVITIES, PART III -- IRRIGATED AND DRYLAND AGRICULTURE WITH ESTIMATES OF PRODUCTION, EMPLOYMENT, AND INCOME EFFECTS ON THE AREA ECONOMY,
Texas Dept. of Water Resources, Austin. Planning and Development Div.
M. Kengla, R. Morey, J. Hull, and H. W. Grubb.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-118904, Price codes: A04 in paper copy, A01 in microfiche. Report No LP-21, August 1979. 63 p, 3 Fig, 17 Tab, 22 Ref, 2 Append.

Descriptors: *Weather modification, *Irrigated land, *Precipitation(Atmospheric), *Economic impact, Groundwater recharge, Agriculture, Texas, Income analysis, Employment, Dry farming, Rainfall, Cloud seeding, Input-output analysis meteorology.

As part of the 'High Plains Cooperative Experiment' (HIPLEX) a 14 county area of Texas, the Big Spring-Synder area, was studied to determine the economic effects of increased rainfall on the area. Precipitation in the area varys from about 14 to 22 inches annually. Approximately 90% of the area is used for crops and livestock and of this area 8.5% is irrigated. Economic effects investigated were the potential savings in irrigation water used, irrigation cost reduction, and increased farm income. A rainfall increase of 10% during the growing season, April to October, was used to determine the benefits. Historical rainfall data recorded from 1940-1970 were used as the base for deriving values for the 10% increase. An input output model was used to estimate related non-farm economic effects. Results indicate that the 10% rainfall increase would replace 22,800 acre feet of groundwater that is currently being pumped out for irrigation and this in turn would result in a $574,200 annual savings in irrigation costs. This savings in irrigation costs would mean a $370,000 annual increase in regional income and an overall $3.9 million expansion of the areas output. A $2.3 million increase would result in personal income for the area. (Seigler-IPA)
W80-02730

CONVECTIVE RAINFALL ESTIMATION FROM DIGITAL GOES-1 INFRARED DATA,
Texas A and M Univ., College Station.
G. L. Sickler, and A. H. Thompson.
Available from the National Technical Information Service, Springfield, VA 22161 as N79-31885, Price codes: A05 in paper copy, A01 in microfiche. NASA Reference Publication 1034, September 1979. 94 p, 32 Fig, 5 Tab, 29 Ref, 2 Append.

Descriptors: *Rainfall intensity, *Convection, *Meteorological data, *Satellites(Artificial), Synoptic analysis, Infrared radiation, Texas, Clouds, Cloud physics, Digital computers, Rain gages, Rainfall, Meteorology, GOES-1.

Estimated corrective rainfall amounts from digital GOES-1 (Geostationary Operational Environmental Satellite) infrared data are compared to actual raingauge measured rainfall amounts. GOES-1, a meteorological satellite, is positioned 35,800 Km above the equator and maintains a position perpendicular to the earth's equatorial plane. Onboard is a visible infrared spin-scan radiometer that maps clouds in the upper atmosphere. The study area used was a 240 Km sq area in Texas. Digital GOES-1 data were obtained from Man Computer Interactive Data Access System (McIDAS) ninetrack tapes at the University of Wisconsin. Some rawinsonde and synoptic data were also used. Raingauge groundtruth data were obtained from the National Climate Center publication for May 1978 in hourly segments. These data are supplemented by National Weather Service radar summaries and digital radar information. Results show a 0.92 correlation between observed and convective rainfall amounts. Overall the results demonstrate that digital geostationary infrared satellite data is a usefully accurate tool for the estimation of convective rainfall amounts. (Seigler-IPA)
W80-02739

MALVERN URBAN TEST CATCHMENT VOLUME 11,
Canada Centre for Inland Waters, Burlington (Ontario).
J. Marsalek.
Available from Training and Technology Transfer Division (Water), Environmental Protection Service, Environment Canada, Ottawa, Ontario, Canada, K1A 1C8. Canada-Ontario Agreement on Great Lakes Water Quality, Research Report No 95, 1979. 66 p, 10 Fig, 11 Tab, 8 Ref, 1 App. 73-3-12.

Descriptors: *Watersheds(Basins), *Rainfall, *Runoff, Water quality, Hydrology, Hydrographs, Instrumentation, Data collections, Model studies, Monitoring, Burlington, Ontario.

The monitoring of rainfall-runoff events in the Malvern urban catchment was continued during 1974. A large number of rainfall-runoff events were recorded. Seventeen rainfall-runoff events were selected for further study and fairly accurately reproduced by means of the U.S. Environmental Protection Agency's Storm Water Management Model. Lake in the field season, monitoring of runoff quality was initiated. Only several runoff pollutographs were successfully recorded. These pollutographs were used to study the feasibility of simulating runoff quality in the Malvern catchment. (WATDOC)
W80-02844

METHODS OF COMPARING ANNUAL RAINFALL RECORDS FOR CLIMATIC PURPOSES,
University of East Anglia, Norwich (England). Climatic Research Unit.
J. M. Craddock.
Weather, Vol 34, No 9, p 332-346, September 1979. 6 Fig, 3 Tab, 7 Ref.

Descriptors: *Rainfall, *Climatology, *Basic data collections, *Analysis, Analytical techniques, Statistical methods, Estimating, Baseline studies, Graphical analysis, Foreign research, *England, Annual rainfall, Record extension.

This investigation sought to determine how a rainfall record made at one site could be used to extend the record at another, a problem which arises repeatedly in any serious attempt to describe the British climatic history of the last 250 years. If once it can be established how far afield it is profitable to go, then evidence from all the stations within the limiting radius can be combined to estimate for the wanted site. Five methods applied to each of 27 sets of data to produce statistics which help to describe the nature of the relationship included the method of annual ratios, methods of double-mass graphs and cumulative deviations, exponential smoothing of the conversion ratio, and the method of mixed adjustment. The methods described were applied to pairs of annual rainfall records from stations separated by distances ranging from a few feet up to 300 miles and mostly covering periods of 43 years. In not one of the 27 experiments did the results encourage the supposition that the ratio of the annual catches shows only random departures from a mean value. The method of cumulative deviations is an effective tool for comparing records for past years, but the fact that a separate graph has to be plotted for each comparison limits the extent to which it can be applied. The method of mixed adjustment provides an objective means of identifying phase changes in the past and of identifying changes within a year or two of their occurrence. (Humphreys-ISWS)
W80-02867

SPATIAL AND TEMPORAL CORRELATION OF PRECIPITATION IN ILLINOIS,
Illinois State Water Survey, Urbana.
F. A. Huff.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-137706, Price codes: A02 in paper copy, A01 in microfiche. ISWS Circular 141, 1979. 14 p, 6 Fig, 6 Tab, 6 Ref.

Descriptors: *Precipitation(Atmospheric), *Illinois, *Distribution, *Rainfall disposition, Analysis, Correlation analysis, Spatial distribution, Temporal distribution, Storms, Seasonal, Annual, Sampling, Networks, Data collections.

Analysis were made of the correlation patterns of annual, seasonal, monthly, storm, and partial storm precipitation in Illinois, with major emphasis on the warm season months of May-September when convective rainfall dominates and spatial variability maximizes. Data were from the climatic network of the National Weather Service in the annual analysis, and that from dense raingage networks of the State Water Survey in the seasonal, monthly, and storm analysis. Results provide knowledge and basic information concerning the spatial and temporal distribution characteristics of precipitation. This is needed in various endeavors, such as hydrologic studies, weather modification experiments, and agricultural research in which precipitation sampling to meet certain standards of accuracy is pertinent to the success of the project. (Humphreys-ISWS)
W80-02882

RAINFALL CHANGES IN SUMMER CAUSED BY ST. LOUIS,
Illinois State Water Survey, Urbana.
S. A. Changnon, Jr.
Science, Vol 205, No 4404, p 402-404, July 27, 1979. 1 Fig, 1 Tab, 17 Ref. NSF ENV-77-15375.

Descriptors: *Rainfall, *Cities, *Distribution patterns, *Summer, Statistics, Statistical methods, Winds, Storms, Weather, Precipitation(Atmospheric), Effects, Meteorology, *St. Louis(MO).

Precipitation in and around St. Louis was investigated to study urban influences on summer precipitation conditions. Prerain winds were used to define the 'downwind area' where influences would be greatest, and wind-sorted rains were combined into monthly and summer totals. Of the 16 rain patterns, 75% revealed a rainfall maximization downwind of the city, and the rainfall in the downwind area was 22.7% more than the rainfall upwind of St. Louis where no urban influences existed. Various statistical tests of the summer rain-

fall distribution revealed the downwind rainfall to be significantly greater than elsewhere and supportive of other findings that St. Louis increases rainfall. (Sims-ISWS)
W80-02884

THE RELATIONSHIP BETWEEN ANNUAL RAINFALL AND PAN EVAPORATION IN AUSTRALIA,
State Electricity Commission of Victoria, Melbourne (Australia).
For primary bibliographic entry see Field 2D.
W80-02885

A METHOD FOR MODELING THE DEPOSITION OF SULFUR BY PRECIPITATION OVER REGIONAL SCALES,
Argonne National Lab., IL. Atmospheric Physics Section.
For primary bibliographic entry see Field 5B.
W80-02886

ERROR ANALYSIS APPLIED TO INDIRECT METHODS FOR PRECIPITATION ACIDITY,
California Inst. of Tech., Pasadena. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 2K.
W80-02887

TEMPORAL FLUCTUATIONS OF SEASONAL PRECIPITATION IN JERUSALEM,
Ben Gurion Univ. of the Negev, Beersheba (Israel). Inst. of Desert Research.
A. Zangvil.
Tellus, Vol 31, No 5, p 413-420, October 1979. 4 Fig, 1 Tab, 20 Ref.

Descriptors: *Precipitation(Atmospheric), *Seasonal, *Time series analysis, Temporal distribution, Analytical techniques, Annual, Data collections, Rainfall, Data processing, Fluctuations, Variability, Climatology, *Israel, *Jerusalem(Israel).

The annual rainfall in Jerusalem during the period 1846-47 to 1953-54 was studied by the method of time spectrum analysis and filtering techniques. The effect of different methods of spectral presentations was then demonstrated. A prominent significant peak appears in the spectrum at a period of 3.0-3.3 years, and a secondary peak is evident at 2.15 years. More than 55% of the total variance of annual rainfall in Jerusalem is concentrated in the period band between 2 and 4.3 years. The above two peaks were compared with published spectra of rainfall and other meteorological parameters in other parts of the world and were found to be compatible with the Southern Oscillation and the Quasi Biennial Oscillation, respectively. When the data were subdivided into two equal subperiods, the 3.0-3.3 years' peak remained the dominant feature in both spectra, whereas the 2.15 years' peak disappeared altogether in the second subperiod. The implications of this behavior were discussed. (Sims-ISWS)
W80-02888

NILE RIVER DISCHARGE,
National Center for Atmospheric Research, Boulder, CO.
H. Riehl, M. El-Bakry, and J. Meitin.
Monthly Weather Review, Vol 107, No 11, p 1546-1553, November 1979. 4 Fig, 3 Tab, 13 Ref.

Descriptors: *Rivers, *Discharge(Water), *Precipitation(Atmospheric), *Climatology, *Africa, Streamflow, Watersheds(Basins), Runoff, Climates, Climatic data, Rainfall, Remote sensing, Satellites(Artificial), Meteorology, *Nile River, *Aswan(Egypt), *Cairo(Egypt), *Egypt.

Based on 106 years of measured streamflow of the Nile River above Aswan, Egypt, and on readings of the annual high river flow at Cairo from the year 1700, the question of possible short-period climate changes in the source region for the water was examined. The problem of random time series was discussed; the runoff record of the Colorado River was considered in comparison. A 115-year cycle from 1725 to 1840 was compared with the still continuing subsequent regime of high flow followed by low flow. The difference between high- and low-flow periods was near 25% of average in both cases, representing a large change in available water supply. Mean annual discharge was measured as 91 cu km/yr from 1870 to 1976 and was estimated as slightly less, 87 cu km/yr, for 1725-1840, due to lower computed annual discharge in about half of the years with high flow. Variability in Nile discharge is thought to be mainly related to changes in precipitation over the Ethiopian mountains. Preliminary analysis of satellite radiation temperatures for June-September 1974 showed a marked diurnal regime with low radiation temperatures concentrated in the late part of the day. However, there are periods from 1 to 8 days with suppressed diurnal variation. Five such periods account for half of the days when radiation temperature of -30C or lower, indicative of substantial cumulonimbus presence, prevailed both day and night, mainly clustered around the high mountains. Suggestions for future research evolved from these observations. (Sims-ISWS)
W80-02901

THE DIURNAL VARIABILITY OF FLORIDA RAINFALL,
State Univ. of New York at Albany. Dept. of Atmospheric Science.
B. E. Schwartz, and L. F. Bosart.
Monthly Weather Review, Vol 107, No 11, p 1535-1545, November 1979. 14 Fig, 2 Tab, 15 Ref, NSF ATM 75-1968A01, ATM78-00531.

Descriptors: *Rainfall, *Variability, *Diurnal, *Florida, Precipitation(Atmospheric), Data processing, Analytical techniques, Climatic data, Seasonal, Storms, Weather, Climatology, Harmonic analysis.

The diurnal variation of precipitation over the Florida peninsula was investigated on the basis of harmonic analysis of hourly rainfall data. Hourly data on the frequency of three categories of precipitation events for around 70 stations in Florida were processed, generating statistics of amplitude and phase of the diurnal precipitation cycle at each station. Results were shown for all stations for the seasonal totals and for a selected cross section of stations for the detailed monthly totals. During the winter months, a small morning maximum occurs in the northwest, shifting abruptly to early afternoon across the northern panhandle. Most of the state during the remainder of the year depicts afternoon maxima. Interesting exceptions occur in the northwest and the Keys. The amplitude of the afternoon maximum decreases toward coastal areas, suggesting that nocturnal rainfall decreases the relative importance of the afternoon maximum at these locations. It was suggested that the character of the harmonic analysis for individual locations is related to probable effects of the location of the sea breeze convergence zone and the influence of extra-tropical disturbances such as quasi-stationary fronts. The large-scale flow is decisive to the timing and onset of precipitation, a fact that emerges even in the absence of wind stratification of the data. Most locations throughout the state do not show any significant semi-diurnal character in their data, and results for the diurnal precipitation cycle remain relatively consistent through all categories of precipitation. (Sims-ISWS)
W80-02902

A MODEL FOR OROGRAPHIC PRECIPITATION IN THE NORTH-CENTRAL GREAT BASIN,
Nevada Univ., Reno. Dept. of Geography.
J. G. Houghton.
Monthly Weather Review, Vol 107, No 11, p 1462-1475, November 1979. 9 Fig, 2 Tab, 18 Ref, 3 Append.

Descriptors: *Precipitation(Atmospheric), *Orography, *Great Basin, Mountains, Effects, Data processing, Regression analysis, Rainfall, Snowfall, Air circulation, Moisture, Cloud physics, Meteorology, Orographic precipitation.

The orographic effect, measured as the ratio of mountain to valley precipitation at 72 pairs of stations in the north-central Great Basin, was tested against 29 relief, location, and synoptic parameters. Parameters found significant were then subjected to stepwise multiple regression to develop equations explaining the spatial variation of precipitation for each calendar month, two synoptic seasons, and the year. The monthly and seasonal equations explained 52-83% of spatial variance and the annual equation explained 65%. They showed that the ratio increased with station elevation difference and in winter with proximity to the Pacific Ocean; significant relationships also occurred with station pair orientation, and in summer with ocean direction and Pacific storm rainfall. Best results were obtained either for pairs with long-term records or those with both stations topographically close together. An equation using mean monthly Great Basin wind speed and Pacific storm rainfall explained 88% of the annual variation in the Basin mean monthly orographic ratio. (Sims-ISWS)
W80-02903

2C. Snow, Ice, and Frost

REGIONAL PATTERNS OF CONTAMINANTS (PAH, PESTICIDES AND TRACE METALS) IN SNOW OF NORTHEAST BAVARIA AND THEIR RELATIONSHIP TO HUMAN INFLUENCE AND OROGRAPHIC EFFECTS,
Bayreuth Univ. (Germany, F.R.). Lehrsteuhl fuer Hydrologie.
For primary bibliographic entry see Field 5B.
W80-02896

2D. Evaporation and Transpiration

THE RELATIONSHIP BETWEEN ANNUAL RAINFALL AND PAN EVAPORATION IN AUSTRALIA,
State Electricity Commission of Victoria, Melbourne (Australia).
R. D. Hoy.
Australian Meteorological Magazine, Vol 26, No 2, p 45-54, June 1978. 3 Fig, 3 Tab, 14 Ref.

Descriptors: *Evaporation, *Rainfall, *Precipitation(Atmospheric), *Australia, Regression analysis, Meteorology, Hydrology, Climates, Climatology, Evaporation pans, *Annual rainfall, Regression line, Rainfall variation, Surface moisture.

Annual totals of pan evaporation and rainfall are shown to be inversely correlated over much of inland Australia. The slope of the regression line is most negative in the interior of the continent and becomes less negative or zero near the coast. Over much of inland Australia, the year-to-year variation in pan evaporation is greater than the corresponding rainfall variation. The relationships found may be used to determine the annual pan evaporation associated with annual rainfall totals. (Roberts-ISWS)
W80-02885

EVAPOTRANSPIRATION UNDER DEPLETING SOIL MOISTURE,
Kasetsart Univ., Bangkok (Thailand).
W. Boonyatharokul, and W. R. Walker.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol 105, No IR4, Proceedings Paper 15018, p 391-402, December 1979. 7 Fig, 1 Tab, 10 Ref, 2 Append, EPA R-804827.

Descriptors: *Evapotranspiration, *Irrigation practices, *Soil moisture, *Model studies, *Colorado, Mathematical models, On-site investigations, Lysimeters, Irrigation, Irrigation efficiency, Scheduling, Crops, Alfalfa, Moisture deficit, Farm management.

Data from two hydraulic weighing lysimeters planted to alfalfa were used to calibrate a simplified root extraction sink term in a model of the one-dimensional continuity equation. The model was then utilized to generate the expected response of alfalfa to depleting soil moisture levels for a

wide range of possible soil and atmospheric conditions. This information led to the calculation of values for the K sub s stress coefficient employed in irrigation scheduling programs. A new relationship describing the reductions in evapotranspiration as the soil moisture reservoir is depleted was formulated. The calibration data were also employed to evaluate the commonly used logarithmic and linear soil moisture stress models. The results indicated that both models reasonably predicted measured data until the available soil moisture in the root zone diminished below about 50%. (Sims-ISWS)
W80-02909

2E. Streamflow and Runoff

FLOOD HAZARD STUDY -- MARLBOROUGH, NEW HAMPSHIRE: MINNEWAWA BROOK, ROBBINS BROOK, AND SOUTH BRANCH ASHUELOT RIVER.
Soil Conservation Service, Durham, NH.
In cooperation with the NH Office of Comprehensive Planning and the Town of Marlborough, March 1979. 44 p, 18 Fig, 5 Tab, 11 Ref, 10 Append.

Descriptors: *Flood profiles, *Flood plains, *New Hampshire, *Flood control, Dams, Flow control, Water management(Applied), Ice jams, Melting, Snow cover, Channel flow, Watershed management, Hydroelectric plants, Water levels.

Sections of three streams in Marlborough, New Hampshire, were studied to promote public awareness of flood plain areas and to devise a flood plain management plan. The town has predominantly fast flowing streams with narrow flood plains. Much development has occurred at the wider places along the flood plains. Historically, flooding has occurred in all seasons with major floods in 1818, 1826, 1927, 1936, 1938, 1959, and 1976. Causes of flooding include heavy rains, melting snow, hurricanes, and ice jams with ice jams causing the major problems. Route 12, Route 101, and many smaller streets are inundated during a 100-year or larger flood. Until 1968 the Public Service Company operated a dam above the town for electric power production. When generation stopped several changes occurred that have increased ice jam problems including the removal of a control conduit, increased flood plain development, and narrowing of channels. Also the old dam is rapidly deteriorating and should it be removed future flood potential would be greatly increased. Flood hazard area photomaps and profiles are presented along with a flood plain management plan for the area. Photographs showing the depth of flooding likely to occur at various points are also provided. (Seigler-IPA)
W80-02729

FACTORS INFLUENCING THE LOW PHYTOPLANKTON STANDING CROP IN SUISUN BAY DURING THE 1976-1977 DROUGHT,
Bureau of Reclamation Sacramento, CA.
J. F. Arthur, and M. D. Ball.
Report 1979. 93 p, 32 Fig, 7 Tab, 16 Ref.

Descriptors: *Phytoplankton, *California, *Droughts, *Low flow, Discharge(Water), Benthic fauna, Aquatic algae, Eutrophication, Estuaries, Bays, Trap efficiency, Light penetration, Nutrients, Salinity, Zooplankton, Toxins, Deltas, Parasitism, Water temperature.

During the record dry consecutive years 1976 and 1977, the standing crop of phytoplankton in the Suisun Bay, California, declined rather than increasing as it had done during previous dry periods. Field and laboratory studies of low river discharge into the San Francisco Bay-Delta Estuary and related factors were conducted to determine the cause(s) for the low p hytoplankton occurrence. Nine factors were evaluated as possible causes: (1) available light as factors of solar radiation and water transparency, (2) water temperatures, (3) nutrients, (4) toxicity, (5) parasitism, (6) high salinity, (7) zooplankton grazing, (8) benthic filter feeding, and (9) entrapment zone location relative to shallow bays. In general, measurements of these factors during the dry years were compared to values from previous years. All factors except benthic filter feeding and entrapment zone location were eliminated as probable causes. Although the low Delta outflow conditions of the drought caused a benthic organism influx, indirect evidence indicates that the influx did not cause the low phytoplankton standing crop. Evidence does indicate that the movement of the entrapment zone from the channel and shallow production waters of the Suisun Bay into the Sacramento and San Joaquin River system was probably the cause for the phytoplankton decrease. (Seigler-IPA)
W80-02741

A MODEL FOR WATER CIRCULATION AND SOLUTE TRANSPORT IN POOL NO. 2 OF THE MISSISSIPPI RIVER,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
H. Stefan, and A. Demetracopoulos.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-134695, Price codes: A06 in paper copy, A01 in microfiche. Project Report No 186, Oct 1979. 85 p. OWRT A-039-MINN(1).

Descriptors: *Mississippi River, *Water circulation, Water quality, Mathematical model, Low flow, *Mass transfer, Backwater, Locks, Dams, Minnesota.

Low flow water circulation in Pool No. 2 of the Mississippi River was analyzed and the resulting flow distribution was used for the computation of mass (solute) transport through the system. The study establishes a basis for dynamic water quality modelling at a very short time-scale as appropriate e.g. for dissolved oxygen or suspended solids. The river reach analyzed receives the effluent from the Metropolitan waste treatment plant (Pig's Eye Plant), but has also great recreation potential because of its proximity to the Twin Cities. Pool No. 2 of the Mississippi River has a fairly complex geometry. It was analyzed as a network of 17 fixed boundary segments, taking into account gravity forces, bad shear stresses, local (minor) energy losses and wind effects. The hydrodynamic equations were solved for quasi-steady state conditions. A 6-hour time interval was used, and the validity of this choice was verified by a transient response analysis of the system. The mass transport was analyzed with a cells-in-series type model. Division of the fixed boundary segments into a variable number of sub-segments was used to account for the observed dispersion. Good agreement was found between computed time-concentration curves and three sets of measured dye concentrations. The hydrodynamic and transport model described herein is the basis for a water quality model now under development. (Blake-Minn)
W80-02763

WETLANDS AND ORGANIC SOILS FOR THE CONTROL OF URBAN STORMWATER,
Hickok (Eugene A.) and Associates, Wayzata, MN.
E. A. Hickok.
In: Lake Restoration, Report No EPA 440/5-79-001, p 153-158, 1979. 3 Fig, 6 Tab.

Descriptors: *Storm runoff, *Watersheds(Basins), *Urban runoff, *Organic soils, Phosphorus, Minnesota, Wetlands, Adsorption, Organic matter, Soils, Waste assimilative capacity, Marshes, Water treatment, Eutrophication, Sediment control.

A seven-acre wetland in the Minnehaha Creek Watershed District, Minnesota, was studied during 1974 through 1975 to determine its effect on stormwater runs. Influent and effluent water sources and amounts were monitored to develop water and nutrient balances. Instrumentation used includes 5 parshall flumes, 13 polyvinyl chloride observation wells, and a complete weather observation station. Physical entrapment, microbial utilization, plant uptake, and adsorption were all found to be active mechanisms in the wetland system. The phosphorus adsorptive capacity of the area indicated that the organic soils of the watershed contain between 5 and 17 times the amount of phosphorus expected. Application of study results led to the development of five projects: (1) extensive environmental planning and construction was done for the building of a new shopping center in the study area; (2) a biologically activated soil filtration unit was constructed to filter phosphorus from the hypolimnion water of Wirth Lake in Minneapolis; (3) an oil retention basin, a six-acre wetland treatment area, and a filter dyke for drawdown were developed for a watershed at the Minneapolis St. Paul airport; (4) a marsh is being utilized by Annandale, Minnesota, to treat combined urban runoff and treated wastewater; and (5) organic soils and wetlands are being used for the Long Lake Restoration Project. (See also W80-02773) (Seigler-IPA)
W80-02797

FLOOD LOSSES: WHY CAN'T WE ANSWER EVERYONE'S QUESTIONS,
Office of the Chief Engineer (Army), Washington, DC.
G. R. Phippen.
In: Natural Hazards Data Resources: Uses and Needs; Program on Technology, Environment and Man, Monograph 27; Institute of Behavioral Science, Colorado University p 73-79 1979. 1 Fig, 1 Tab.

Descriptors: *Flood data, *Flood damage, *Data collections, Hydrologic data, Federal government, Flood protection, Historic floods, Flood plain insurance, Maximum probable flood, Design floods, Water policy, Statistics.

While it is generally agreed that a systematic, universal flood loss record is needed it would be quite expensive and it is therefore unlikely that such a record will be developed. Most flood loss data to date is site-specific with a large vocabulary that is tailored for user needs rather than general reader needs and many flood-loss terms are often misused. Data users include planners, builders, engineers, program managers, researchers, insurers, and politicians. Because of this wide variety of users many kinds of information are needed. Many recommendations for a national systematic flood-loss data acquisition and analysis have been made but funding would have to come from other water resources agency programs. To date the agencies have been unwilling to commit the necessary funds as they feel that they can get by without the program. Some flood-loss information is assembled by the National Weather Service and by the National Assessment of flood losses provided by the U. S. Water Resources Council. Conditions for a hypothetical river reach using theses data sources are illustrated. A basic weakness of much flood loss data is the inability to draw reasonable conclusions from the comparison of average yearly losses and average annual losses. (Seigler-IPA)
W80-02807

SPECIAL FLOOD HAZARD INFORMATION: WOLF CREEK, GRANADA, COLORADO.
Army Engineer District, Albuquerque, NM.
Prepared for City of Granada, Colorado, April 1974. 26 p, 5 Fig, 5 Plates, 4 Tab.

Descriptors: *Colorado, *Floods, *Flooding, *Indirect flood measurement, *Flood profiles, *Storms, *Cloudbursts, *Historic floods, *Rivers, *Floodways, *Flood protection, *Control structures, *Levee, *Wolf Creek(CO), *Granada(CO), River flow, Streamflow forecasting, Flood forecasting, Design flood, Flood stages, Peak discharge, Flood peak, Flood damage, Flood plain management, Standard Project Flood, Intermediate Regional Flood.

This report presents information on the flood hazard caused by Wolf Creek in the vicinity of Granada, Colorado. Wolf Creek is a tributary of the Arkansas River and has a drainage area of 122 square miles. The drainage area is almost exclusively agricultural. Stream gage records are not available but reports indicate that flooding occurred in 1918, and more recently in 1965 (the largest flood) and 1972. The estimated peak discharge for the 1965 flood is 35,300 cubic feet per second (cfs). Flooding is caused by intense rainfall

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resulting from thunderstorms and cloudbursts. Minimal flood protection exists from a levee around the west and north sections of Granada. Obstructions to floodflow consist of bridges, embankments and natural vegetation. The Standard Project Flood would have a peak discharge of 41,000 cfs, with a main channel velocity of 4 feet per second. The Intermediate Regional Flood would have a peak discharge of 27,000 cfs, with a main channel velocity of 3 feet per second. The report contains flood characteristics for the SPF and IRF if there was a flood control project; this would not affect the peak discharge but would lessen the height of rise above bankfull by more than one foot and increase main channel velocities to 8 and 7 feet per second, respectively, for the SPF and IRF. Guidelines for floodplain management are presented. (Iervolino-NC)
W80-02848

SPECIAL FLOOD HAZARD INFORMATION: ARKANSAS RIVER & TRIBUTARIES, GREAT BEND, KANSAS.
Army Engineer District, Albuquerque, NM.
Prepared for Great Bend, Kansas, April 1976. 33 p, 7 Fig, 12 Plates, 5 Tab.

Descriptors: *Kansas, *Floods, *Flooding, *Flood flow, *Indirect flood measurement, *Design flood, *Flood profiles, *Flood stages, *Peak discharge, *Arkansas River(KS), *Walnut Creek(KS), *Great Bend(KS), Storms, Hurricanes, Historic floods, Flood data, Flood peak, Rivers, Floodways, Flood plains, Standard Project Flood, Flood protection, Control structures, Levee, Dams, Channel improvement, 100-year flood.

The report presents information on the flood hazard areas of the Arkansas Rivers and tributaries in Great Bend, Kansas and vicinity. The drainage area of the Arkansas River study area is 11,796 square miles, and 1,717 square miles for its tributary, Walnut Creek. Almost the entire city of Great Bend is located within the flood plains; development includes residential, commercial, public facilities and utilities. The first recorded flood on the Arkansas River occurred on July 23, 1895. More recent floods occurred in 1951, 1958, and 1965. Data were obtained from the U.S. Geological Survey and historical records. Major flooding occurs during May through September and is caused by long duration rainfall or thunderstorms. Obstructions to flood flows include bridges, embankments and natural vegetation. The John Martin Dam which spans the Arkansas River 286 miles upstream from Great Bend was constructed for flood control and will control floods up to and including the Standard Project Flood. Other flood control measures include local levee construction and channel improvements. A public river and flood forecasting service is provided for all the Arkansas River Bend, including Great Bend. The largest recorded flood occurred in June 1965, discharging 27,800 cubic feet per second (cfs) at Great Bend. At the same location the Standard Project Flood (SPF) would discharge 76,000 cfs while the 100-year flood would discharge 42,000 cfs. On Walnut Creek the SPF and 100-year floods would discharge 69,000 cfs and 27,200 cfs, respectively. This report furnishes a suitable basis for adoption of land use controls to guide flood plain development. (Iervolino-NC)
W80-02849

SPECIAL FLOOD HAZARD INFORMATION: CLEARWATER CREEK, RICE CREEK WATERSHED, CENTERVILLE, LINO LAKES, HUGO, MINNESOTA.
Army Engineer District, St. Paul, MN.
Prepared for Rice Creek Watershed District, June 1975. 50 p, 15 Fig, 13 Plates, 7 Tab.

Descriptors: *Minnesota, *Floods, *Flooding, *Flood flow, *Indirect flood measurement, *Flood profiles, *Design flood, *Storms, *Flood protection, *Clearwater Creek(MN), *Centerville(MN), *Lino Lakes(MN), *Amoka County(MN), *Washington County(MN), *Hugo(MN), Flood forecasting, Historic floods, Flood stages, Peak discharge, Flood peak, Rivers, Floodways, Flood plains, Flood plain management, Standard Project Flood, Non-structural alternatives, Flood plain zoning, Land use, Planning, Zoning, Control structures, Dikes, Intermediate Regional Flood.

The study area covers the flood plain for Clearwater Creek in the vicinity of the Cities of Hugo, Lino Lakes and Centerville, Minnesota. The area included in this study is located along the Creek from the outlet of Bald Eagle Lake to the mouth at Peltier Lake and includes two branches which are tributary to the main stem. The drainage area of this section of Clearwater Creek is 62 square miles. The major portion of the study area is either developed for agricultural purposes or is undeveloped open space. Major flooding can be expected to occur during the summer months as a result of high intensity rainfall. Snowmelt runoff combined with spring rains can also produce major flooding. Obstructions to floodflow are natural and manmade. Records and other documentation concerning past floods are not available; the history of flooding is from personal accounts of nearby residents. For the Intermediate Regional Flood the peak discharge would range from 150 cubic feet per second (cfs) to 1780 cfs, with flood elevations ranging from 905 to 913 feet above sea level. For the Standard Project Flood the peak discharges would range from 520 cfs to 4380 cfs, with flood elevations ranging from 194.7 to 914 feet above sea level. The control structure for Bald Eagle Lake and the drainage ditch improvements are the only structural flood control measures in the study area. Special zoning districts have been adopted by the City of Hugo for lakeshore and flood hazard areas. Water resource management planning in the study area has generally been limited to the planning accomplished by the Rice Creek Watershed District. Flood plain management techniques are discussed. This report is intended to provide knowledge of flood potential and hazards for land use planning. (Iervolino-NC)
W80-02850

SPECIAL FLOOD HAZARD INFORMATION: GYPSUM AND DRY CREEKS, WICHITA, KANSAS.
Army Engineer District, Tulsa, OK.
Prepared for City of Wichita, KS, January 1976. 18 p, 4 Fig, 14 Plates, 3 Tab.

Descriptors: *Kansas, *Floods, *Flooding, *Flood flow, *Indirect flood measurement, *Wichita(KS), *Gypsum Creek(KS), *Dry Creek(KS), Flash flood, River forecasting, Flood forecasting, Design flood, Storms, Thunderstorms, Historic floods, Flood data, Flood stages, Peak discharge, Flood peak, Flood damage, Rivers, Floodways, Flood plain management, Standard Project Flood, Flood protection, Warning systems, Intermediate Regional Flood.

The study area is the flood plains of Gypsum Creek and Dry Creek at Wichita, Kansas. The drainage area for Gypsum Creek is 22 square miles and 4.2 square miles for Dry Creek. Gypsum Creek has a slope of 11 feet per mile and Dry Creek descends at 19.5 feet per mile. Urban development covers 35% of the Gypsum Creek Watershed and 90% of the Dry Creek Watershed. Flooding occurs from May until September and is caused by intense thunderstorms. Obstructions to the floodflow are caused by bridges, culverts, shrubbery and debris. The record flood occurred on August 24, 1960 and caused about 8 feet of flooding near the confluence of Gypsum and Dry Creeks. Other floods occurred in 1959, 1963 and 1964. For the Intermediate Regional Flood the peak flow of Gypsum Creek would be 9,900 cubic feet per second (cfs) and for Dry Creek it would be 4,100 cfs. The Standard Project Flood would discharge 19,250 cfs on Gypsum Creek and 6,800 cfs on Dry Creek. The National Weather Service in cooperation with the City of Wichita has plans for the establishment of a Flash Flood Warning Program for Gypsum and Dry Creeks Basins. The program will include rain gage and staff river gage stations within the basins with a flash alarm gage to be installed. Guidelines for flood plain management are presented. (Iervolino-NC)
W80-02851

SPECIAL FLOOD HAZARD INFORMATION REPORT: SANDY LICK CREEK, CITY OF DUBOIS, CLEARFIELD COUNTY, PENNSYLVANIA.
Army Engineer District, Pittsburgh, PA.
Prepared for The City of Dubois and the Commonwealth of Pennsylvania, Dept. of Environmental Resources, June 1975. 4 p, 3 Plates, 2 Tab.

Descriptors: *Pennsylvania, *Floods, *Flooding, *Flood flow, *Flood stages, *Dubois(PA), *Sandy Lick Creek(PA), *Clearfield County(PA), Indirect flood measurement, Flood forecasting, Design flood, Flood profiles, Historic floods, Peak discharge, Rivers, Floodways, Flood plains, Flood protection, Control structures, Channel improvement, 100-year flood, 500-year flood.

The study area is the floodplain for Sandy Lick Creek in the vicinity of the City of Dubois in Clearfield County, PA. Studied is a 4.66 mile stretch of the creek which has a total drainage area of 231 square miles. Sandy Lick Creek has several tributaries within the study reach, the two main ones being Wolf Run and Laborde Branch. These two have a combined drainage area of 42.1 square miles. The main channel slope of Sandy Lick Creek varies from 3.5 feet per mile for most of its length to about 600 feet per mile in the upper extremities. Development within the flood plain consists of roads, education and recreational facilities, business and commercial structures and some scattered residences. At the time of the report a flood control project on Sandy Lick Creek and Beaver Run was under construction. The project consists of approximately 25,000 lineal feet of channel improvement and was expected to be completed by late 1976. The highest known flood occurred in 1972 reaching an elevation of 1,399 feet above mean sea level (msl); other recent floods have occurred in 1964 and 1967. The 100-year flood would reach an elevation of 1398.9 feet msl with a peak discharge of 4,500 cubic feet per second (cfs). The 500-year flood would reach an elevation of 1402.6 feet msl and have a peak discharge of 7,200 cfs. The report is intended to provide a basis for further study to plan for the solution of flood problems. (Iervolino-NC)
W80-02852

SPECIAL FLOOD HAZARD INFORMATION: ARKANSAS RIVER, ANDERSON AND KING ARROYOS, LA JUNTA, OTERO COUNTY, CO.
Army Engineer District, Albuquerque, NM.
Prepared for City of La Junta, Colorado and Otero County, August 1977. 29 p, 28 Plates, 4 Tab.

Descriptors: *Colorado, *Floods, *Runoff, *Flooding, *Surface runoff, *Indirect flood measurement, *Design flood, *Flood profiles, *Storms, *Historic floods, *Flood stages, *Peak discharge, *Flood peak, *Arkansas River(CO), *King Arroyo(CO), *Anderson Arroyo(CO), *La Junta(CO), *Otero County(CO), Maximum probable flood, Flood forecasting, Flood data, Flood damage, Erosion, Rivers, Floodways, Flood plains, Standard Project Flood, Flood protection, Control structures, Levee, Channel improvement, Intermediate Regional Flood.

This report presents information on the flood hazards at and in the vicinity of La Junta, Colorado caused by flooding from the Arkansas River and two of its tributaries, King Arroyo and Anderson Arroyo. In the study reach of the Arkansas River the gradient fluctuates between five and nine feet per mile, with an average of 6.7 feet per mile, with a drainage area of 12,210 square miles. Both arroyos are right bank tributaries of the Arkansas River and have a combined drainage area of 79 square miles. Developments in the flood plains include residential, commercial and industrial structures, utilities and transportation facilities. Floods in the study area are of two general types: spring floods resulting from melting snow augmented by storm runoff and summer floods resulting from storm runoff. Obstructions to floodflow consist of natural vegetation and bridges. The earliest known flood occurred in 1826; more recent major floods occurred in 1965, 1969 and 1972. For the 100-year flood the peak discharges would be 92,000 cubic feet per second (cfs), 7,500 cfs and

10,500 cfs for the Arkansas River, King Arroyo and Anderson Arroyo, respectively. For the Standard Project Flood the peak discharge on the Arkansas River would be 212,000 cfs. Levees have been constructed along the Arkansas River as a flood damage reduction measure but they are substandard. The proposed La Junta Local Protection Project consists of levee construction, channelization work, bank protective stabilization work and landside interior drainage ditches. (Iervolino-NC)
W80-02854

SPECIAL FLOOD HAZARD INFORMATION: CIBOLO CREEK, PRESIDIO & SHAFTER, TEXAS.
Army Engineer District, Albuquerque, NM.
Prepared for Presidio and Shafter, Texas, March 1976. 14 p, 17 Plates, 1 Tab.

Descriptors: *Texas, *Floods, *Flooding, *Indirect flood measurement, *Flood forecasting, *Flood profiles, *Flood stages, *Peak discharge, *Cibolo Creek(TX), *Presidio(TX), *Shafter(TX), Flood flow, River flow, Storms, Thunderstorms, Historic floods, Flood data, Flood peak, Flow duration, Stage-discharge relations, Rivers, Floodways, Flood protection, Control structures, Levee, Standard Project Flood, Presidio County(TX), Intermediate Regional Flood.

The study area is the flood plain of the Cibolo Creek in the vicinity of Presidio and Shafter in Presidio County, Texas. The Cibolo Creek is the northbank tributary to the Rio Grande and has a drainage area of 278 square miles. The slope of the creek varies from 70 to 50 feet per mile going downstream. This area, which contains residential development, commercial development, public facilities and agricultural lands, has been extensively damaged in past floods and there exist strong possibilities for possible larger floods. The maximum flood occurred in 1944 when 3,000 acres of farmland were flooded. Other floods occurred in 1904, 1917, 1932, 1958, 1965 and 1974. Data on past floods were collected from the International Boundary and Water Commission, through interviews and at a public meetings. Flooding occurs in the summer and is caused by decaying thunderstorms. Obstructions to floodflow consist of bridges, embankments, landfills, levees and natural features. At Presidio the 100-year flood would have a peak discharge of 36,000 cubic feet per second (cfs), with flood duration of 6 hours, and main channel velocity of 7.8 feet per second (fps). The Standard Project Flood at Presidio would have a peak discharge of 67,000 cfs, with a duration of 7.2 hours, and a main channel velocity of 6.5 fps. Presidio County has constructed levees to control floods but has not adopted any regulations that would control development in flood areas. (Iervolino-NC)
W80-02855

EXPANDED FLOOD PLAIN INFORMATION STUDY: ROWLETT CREEK, DALLAS AND COLLIN COUNTIES, TEXAS.
Army Engineer District, Fort Worth, TX.
Prepared for Cities of Plano, Garland and Richardson, The North Central Texas COG and Texas Dept. of Water Resources. Vol I-General Report, September 1978. 48 p, 3 Fig, 4 Plates, 13 Tab.

Descriptors: *Texas, *Floods, *Flooding, *Flood damage, *Rowlett Creek(TX), *Dallas County(TX), *Collin County(TX), Historic floods, Flood stages, Peak discharge, Frail lands, Rivers, Floodways, Flood plains, Hydrological analysis, Environmental analysis, Standard project flood, Cottonwood Creek(TX), Spring Creek(TX).

The study area is the Rowlett Creek Watershed northeast of Dallas, TX. The watershed is about 137 square miles and in addition to the main stem Rowlett Creek includes two major tributaries--Cottonwood Creek and Spring Creek. Development includes residential, commercial and light industrial structures and such development is rapidly increasing. The main stem channel length of Rowlett Creek is about 31 miles with an average slope of 12 feet per mile. Moderate to large floods have occurred in the watershed in 1933, 1942, 1946, 1947, 1951, 1957, 1962, 1964 and 1977. This report employs the Expanded Flood Plain Information (XFPI) concept which is designed to examine all facets of the flooding problem with respect to existing land use development and relate those results to what could happen under varying conditions of future development. Under 1976 conditions, $200,000 damages can be expected on an average annual basis. Three different policies were developed and flood damages were calculated for future urbanization under the separate policies. Policy 1 signifies unconstrained flood plain development and it was calculated that the flood damages would increase over two hundred-fold above the 1976 condition damages (from $200,000 to $43,000,000). Policy 2 calls for adoption of 100-year flood plain regulations that would reduce flood damages from Policy 1 conditions; flood damages would increase four-fold from 1976 conditions (from $200,000 to $900,000). Policy 3 calls for adoption of 100-year Flood Plain Regulations with Floodway; average annual flood damages would be $360,000. An environmental inventory was conducted. An assessment of nonpoint source pollution was undertaken and findings indicated that pollutant loadings can be expected to increase in an almost direct relationship to urbanization. (Iervolino-NC)
W80-02856

FLOOD HAZARD INFORMATION: SAN MARCOS AND BLANCO RIVERS, SAN MARCOS, TEXAS.
Army Engineer District, Fort Worth, TX.
Prepared for City of San Marcos, Texas, June 1971. 35 p, 7 Fig, 14 Plates, 4 Tab.

Descriptors: *Texas, *Floods, *Flooding, *Indirect flood measurement, *Flood profiles, *Historic floods, *San Marcos(TX), *San Marcos River(TX), *Blanco River(TX), Design flood, Surface runoff, Flood flow, River flow, Flood data, Flood stages, Peak discharge, Flood peak, Flood damage, Erosion, Frail lands, Bank erosion, Rivers, Floodways, Flood plains, Standard Project Flood, Flood plain management, Flood protection, Flood plain insurance, Intermediate Regional Flood.

The report covers the flood hazard information for the San Marcos and Blanco Rivers in the vicinity of San Marcos, Texas. Along with their tributaries--Sink, Purgatory, and Willow Springs Creeks--the two rivers have a drainage area of 1,228.8 square miles. The watershed is characterized by rugged hills, narrow valleys, thin soil cover and frequent outcroppings of rock which, combined with steep stream and valley slopes, are conducive to rapid rainfall runoff rates. This report concerns mainly the upper 5 miles of the San Marcos River. Data were obtained from U.S. Geological Survey records, local residents and field surveys. The five largest floods on the San Marcos River, in descending order of magnitude, were those of September 1921, May 1970, September 1952, 1929 and 1913. Large floods have also occurred on the Blanco River, most recently in 1970. Various plans for reducing flood stages have been formulated by the Corps of Engineers. One project started by the Corps was discontinued at the request of the San Marcos City Council in 1969. The City of San Marcos receives emergency flood insurance coverage under the National Flood Insurance Program. For the 100-year flood peak discharge on the San Marcos River would range between 40,000 to 118,000 cubic feet per second (cfs). The Standard Project Flood's peak discharge would range between 65,900 to 190,000 cfs. The main purpose of this report is to provide guidance for intelligent flood plain land use. (Iervolino-NC)
W80-02872

FLOOD PLAIN INFORMATION: MISSOURI RIVER, BISMARCK-BURLEIGH COUNTY, NORTH DAKOTA.
Army Engineer District, Omaha, NE.
Prepared for City of Bismarck and Burleigh County, August 1974. 36 p, 28 Fig, 16 Plates, 5 Tab.

Descriptors: *North Dakota, *Floods, *Runoff, *Flooding, *Surface runoff, *Flood flow, *Indirect flood measurement, *Flood forecasting, *Design flood, *Flood profiles, *Historic floods, *Flood stages, *Peak discharge, *Flood peak, *Flood protection, *Control structures, *Dams, *Reservoirs, *Bismarck(ND), *Missouri River(ND), *Burleigh County(ND), River flow, Maximum probable flood, River forecasting, Flood data, Flood damage, Rivers, Floodways, Flood plains, Ice jams, Standard Project Flood, Garrison Dam(ND), Fort Peek Dam(ND), Intermediate Regional Flood.

The study area is the 186,355 square mile drainage area of the Missouri River in the vicinity of Bismarck, Burleigh County, ND. The study reach is 41.1 miles long and the flood plain width ranges from 1900 to 1700 feet. Existing land uses in the flood plain are mainly agricultural but considerable residential and commercial development has recently taken place. Two dams were constructed to reduce the flood threat--Fort Peek Dam and Reservoir in 1938 and Garrison Dam in 1953. Annual peak flows in the study area result from discharges from the upstream dams together with storm runoff from the uncontrolled downstream area and occur from March to September. Since the completion of Garrison Dam in 1953 there has not been any flooding in the study reach. Significant floods prior to the dam completion occurred on the Missouri River as early as 1881, with the most recent flood occurring in 1952. Ice jams have contributed to some of the past floods. Obstructions to flood flow consist of natural growth and manmade structures. For the Intermediate Regional Flood peak discharge would range from 96,500 cubic feet per second (cfs) to 122,000 cfs, with flood elevations ranging from 1630.8 to 1655.1 feet mean sea level (msl). For the Standard Project Flood the peak discharge would range from 136,700 to 182,000 cfs, with flood elevation ranging from 1632.8 to 1657.4 feet msl. The report is intended to provide knowledge of flood potential and hazards as important considerations in land use planning and flood plain utilization. (Iervolino-NC)
W80-02873

ON THE ORIGIN AND CHARACTERISTICS OF RIVER CHANNEL PATTERNS,
Sheffield Univ. (England). Dept. of Landscape Architecture.
D. I. Brotherton.
Journal of Hydrology, Vol 44, No 3/4, p 211-230, December 1979. 9 Fig, 1 Tab, 15 Ref.

Descriptors: *Channels, *Channel morphology, *Rivers, Meanders, Braiding, Geomorphology, Discharge(Water), Erosion, Effects, Valleys, *Channel patterns, Secondary current, Braid channel.

A theory of the origin of channel patterns was developed and enabled predictions of relationships and characteristics which were tested. It was concluded that meanders form where the discharge erodes and transports bank particles with comparable ease, while braids characterize rivers with highly erodable banks. In both cases, the bank erosion may be induced either by deposition of input sediment (deposition meander or braid) or directly by a discharge with excess energy (erosion meander or braid). Deposition meanders form where the bank material is fine-grained relative to the deposited sediment; deposition braids where the bank material is coarse-grained or where banks are particularly incoherent and fine-grained. Erosion meanders carry a discharge which entrains bank particles in preference to bed particles and transports them downstream; erosion braids carry a discharge which transfers material from bank to bed without downstream movement. Comparisons were made between patterns, and the effects of discharge, valley slope, channel material, and the quantity and quality of sediment input were explored. The resulting predictions were tested using data from 57 natural rivers. (Lee-ISWS)
W80-02891

THE ROLE OF GROUNDWATER IN STORM RUNOFF,
Windsor Univ. (Ontario). Dept. of Geology.
M. G. Sklash, and R. N. Farvolden.

Journal of Hydrology, Vol 43, No 1/4, p 45-65, October 1979. 18 Fig, 1 Tab, 20 Ref.

Descriptors: *Storm runoff, *Groundwater, *Hydrographs, *Tracers, Snowmelt, Runoff, Groundwater movement, Isotope studies, Oxygen isotopes, Deuterium, Tritium, Watersheds(Basins), Streams, Rainfall, Base flow, Discharge(Water), Hydrology.

Groundwater plays a much more active, responsive, and significant role in the generation of storm and snowmelt runoff in streams than the recent literature on the subject suggests. Basin-wide tracer experiments using environmental isotopes (180, deuterium, tritium) and hydrometric studies carried out in hydrogeologically diverse watersheds indicate that for all except the most intense rainstorms and the most prolific melting days, groundwater dominates the runoff hydrographs in the study basins. The increased groundwater discharge during runoff events is apparently related to a rapid rise in hydraulic head along the perimeter of transient and perennial discharge areas. This groundwater ridging phenomenon probably arises from the almost instantaneous conversion of the near-surface tension-saturated capillary fringe into phreatic water. The ridging precedes, and is apparently independent of, the response of the rest of the basin. In addition to its compatibility with several of the field observations commonly associated with contemporary concepts of runoff generation, the groundwater discharge theory explains some of the temporal variations in stream water chemistry which are not adequately accounted for by other theories. (Sims-ISWS)
W80-02894

NILE RIVER DISCHARGE,
National Center for Atmospheric Research, Boulder, CO.
For primary bibliographic entry see Field 2B.
W80-02901

DISPERSION IN ROUGH RECTANGULAR CHANNELS,
Canterbury Univ., Christchurch (New Zealand). Dept. of Civil Engineering.
E. M. Valentine, and I. R. Wood.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY12, Proceedings Paper 15088, p 1537-1553, December 1979. 10 Fig, 1 Tab, 9 Ref, 2 Append.

Descriptors: *Boundaries(Surfaces), *Roughness(Hydraulic), *Numerical analysis, *Open channel flow, *Tracers, *Eddies, *Dispersion, Hydraulics, Mathematical models, Rivers, Turbulent flow, Solutes, Turbulence, Model studies.

A three-dimensional numerical model was developed from a two-dimensional solution reported previously by the writers. A rectangular 'smooth' laboratory flume was used to verify the model without dead zones; two series of field experiments carried out in a water race then were used to test the model for two different roughness conditions. Despite the simplifications involved in the numerical model, it provides a reasonable description of the process in the channel examined. Principally, there is a delay before the Fickian-type dispersion, and the dispersion coefficients are comparable with those found in the field. Although the theory has not reached a stage where it can be applied to most rivers, it does lend itself to the possibility of a classification system for dead zones in river channels, and it demonstrates the importance of the trapping mechanism to the dispersion process in river channels. (Adams-ISWS)
W80-02910

MATHEMATICAL MODELING OF VEGETATIVE IMPACTS FROM FLUCTUATING FLOOD POOLS,
Iowa State Univ., Ames. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2H.
W80-02916

2F. Groundwater

GROUND-WATER GEOLOGY OF SELECTED WETLANDS IN UNION AND ALEXANDER COUNTIES, ILLINOIS,
Illinois State Geological Survey, Urbana.
E. D. McKay, A. Elzeftawy, and K. Cartwright.
Environmental Geology Notes No 85, July 1979. 46 p, 8 Fig, 10 Tab, 16 Ref, 1 Append.

Descriptors: *Mississippi River, *Wetlands, *Ditches, *Drainage, *Groundwater, Illinois, Hydrogeology, Hydrologic budget, Swamps, Piezometry, Water table, Alluvial channels, Flood plains, Flood discharge.

The hydrogeologic settings and groundwater geology of La Rue Swamp and two wetland areas in the Big Five Districts alluvial plain of the Mississippi River, Illinois, were studied. The study was conducted to determine the impact of proposed surface drainage improvements on the wetlands. In the area, the Mississippi River has cut a deep valley into Paleozoic bedrock while the valley bluffs are Lower Devonian limestones and cherts. The river channel is directly against the upland bedrock that forms the valley's western edge, while the alluvial plain spreads eastward for 6 to 10 kilometers. Field studies conducted include geologic mapping, 37 geologic borings, groundwater discharge temperature measurement, and piezometer measurements of groundwater levels and flow. Laboratory studies of major strata water-conducting properties were used to estimate water movement due to gradients. Results show that groundwater contributions to wetland volumes is minor compared to precipitation, however, surface ditching and drainage will have a definite if small effect on groundwater levels. Even this small level change may have a dramatic change on wetland permanence. Flood water volume and retention time will be reduced due to more rapid drainage. More long-term data are needed to assess the magnitude of change that will occur. (Seigler-IPA)
W80-02736

STATE-OF-THE-ART OF GROUNDWATER MODELING,
Camp, Dresser, and McKee, Inc., Champaign, IL. Water Resources Div.
T. A. Prickett.
Water Supply and Management, Vol 3, No 2, p 134-141, 1979. 80 Ref.

Descriptors: *Mathematical models, *Analog models, *Groundwater management, *Model studies, *Groundwater models, *Sand tank models, *Numeric models, Decision-making, Management, Computer models, Analytical techniques, Groundwater-surface relationships, Digital computers, Water resources management.

Outline of groundwater modeling techniques within the categories of mathematical, sand tank, analog and numerical models is presented. The models discussed are one of two types: groundwater 'flow' or 'transport' models. The term 'flow' refers to the type of model used to provide answers to the quantitative side of groundwater problems; typical 'flow' models would solve problems related to safe yields of well fields, interference effects of nearby wells and surface-water-groundwater relationships. The 'transport' model is a water quality type; typical 'transport' models might include energy considerations, dispersion and diffusion processes, chemical exchange reactions, or multiple fluid effects. Mathematical solutions are models of the particular conditions defined; their applications to field problems are therefore somewhat limited. Four main groups of flow models are discussed: (1) Sand tank models which are a scaled down representation of an aquifer, including its boundary configuration and usually its hydraulic conductivity. (2) Analog models, where the behavior of an aquifer is described by differential equations which are derived from basic principles such as the laws of continuity and conservation of energy. (3) Analog models, which can be subdivided into the three major categories of viscous fluid models, electrical models, and miscellaneous models and techniques. (4) Numerical models, which have been powerful tools in aiding hydrologists in evaluating groundwater resources. Development of the digital computer has made possible the practical use of the techniques in groundwater flow modeling. Numerical models can be subdivided into four groups: finite-difference, finite-element variational, finite-element Galerkin, and miscellaneous. (Iervolino-NC)
W80-02866

GROUND-WATER RESOURCES AND MODEL APPLICATIONS FOR THE EDWARDS (BALCONES FAULT ZONE) AQUIFER IN THE SAN ANTONIO REGION, TEXAS,
Texas Dept. of Water Resources, Austin.
W. B. Klemt, T. R. Knowles, G. R. Elder, and T. W. Sieh.
Report 239, October 1979. 94 p, 30 Fig, 6 Tab, 60 Ref.

Descriptors: *Groundwater resources, *Model studies, *Texas, *Aquifers, *Water management(Applied), *Hydrogeology, Data collections, Natural recharge, Stratigraphy, Water levels, Groundwater recharge, Discharge(Water), Springs, Groundwater movement, Aquifer characteristics, Permeability, Porosity, Mathematical models, Pumping, Water yield, Forecasting, *Edwards aquifer(TX), *Balcones fault zone.

The scope of the study was primarily directed toward the quantitative aspects of groundwater withdrawals, spring flows, and aquifer characteristics. A digital computer model of the Edwards (Balcones Fault Zone) aquifer was successfully verified by taking historical input data (initial heads, pumpage, recharge, and other data) and computing water-level changes and spring flows which agree well with water-level declines and spring flows observed from actual field measurements. The digital computer simulation for the period 1972 through 2049 of the Edwards (Balcones Fault Zone) aquifer in the San Antonio region indicates the following: (1) ignoring any water-quality constraints, the aquifer is capable of meeting projected demands through the year 2049; (2) natural flow of Comal and San Marcos Springs will cease before the year 2020, if projected pumpage in the region occurs at predicted rates; (3) the addition of currently proposed artificial recharge does not result in an appreciable increase in the aquifer's available water; (4) the drought-flood sequence of the 1950's was introduced at various points in the simulation and produced only minor effects when compared to the aquifer's long-term simulation; (5) spring flows at Comal Springs and San Marcos Springs can be maintained through groundwater management plans; and (6) there is sufficient storage in the aquifer to allow spring flow of Comal and San Marcos Springs to be replaced by augmentation pumpage through the year 2020. (Humphreys-ISWS)
W80-02883

A FLOW PATTERN DEDUCED FROM URANIUM DISEQUILIBRIUM STUDIES FOR THE CENOMANIAN CARBONATE AQUIFER OF THE BEERSHEVA REGION, ISRAEL,
Tel Aviv Univ., (Israel). Dept. of Geophysics and Planetary Sciences.
J. Kronfeld, E. Gradsztajn, and A. Yaniv.
Journal of Hydrology, Vol 44, No 3/4, p 305-310, December 1979. 3 Fig, 2 Tab, 4 Ref.

Descriptors: *Isotope studies, *Aquifers, *Groundwater movement, *Uranium radioisotopes, Flow, Carbonate rocks, Calcium, Sulfates, Wells, Leaching, Sampling, Saline water, Groundwater recharge, *Israel.

Changes in the uranium isotopic activity ratio and uranium content are correlated to changes in the calcium and sulphate content in waters from wells in various locations in the Cenomanian aquifer in the Beersheva region. These changes are related to an isotopically non-selective leaching of uranium from the overlying uranium- and sulphate-enriched Senonian rocks as the waters flow. A flow pattern, therefore, can be produced by plotting these systematic changes on a regional map. (Visocky-ISWS)

W80-02889

PORE SIZE DISTRIBUTION, SUCTION AND HYSTERESIS IN UNSATURATED GROUND-WATER FLOW,
Nevada Univ. System, Reno. Water Resources Center.
For primary bibliographic entry see Field 2G.
W80-02892

HYDRAULIC POTENTIAL IN LAKE MICHIGAN BOTTOM SEDIMENTS,
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 2H.
W80-02893

THE ROLE OF GROUNDWATER IN STORM RUNOFF,
Windsor Univ. (Ontario). Dept. of Geology.
For primary bibliographic entry see Field 2E.
W80-02894

HYDROGEOLOGY OF GLACIAL-TERRAIN LAKES, WITH MANAGEMENT AND PLANNING APPLICATIONS,
Wisconsin Univ., Madison. Dept. of Urban and Regional Planning.
For primary bibliographic entry see Field 2A.
W80-02895

SEPTIC TANK WASTEWATER DISPOSAL SYSTEMS AS PHOSPHORUS SOURCES FOR SURFACE WATERS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W80-02904

SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER RESOURCES--PACIFIC NORTHWEST REGION,
Geological Survey, Seattle, WA. Water Resources Div.
B. L. Foxworthy.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $2.25 Geological Survey Professional Paper 813-S, 1979. 39 p, 9 Fig, 2 Tab, 104 Ref.

Descriptors: *Groundwater resources, *Pacific Northwest U.S., *Aquifer characteristics, *Withdrawal, *Water demand, Water quality, Water supply, Groundwater availability, Projections, Evaluation, Aquifer management, Idaho, Oregon, Washington.

The Pacific Northwest Region's ground-water reservoirs are capable of providing large additional freshwater supplies, which become more important as surface-storage sites and unapportioned surface-water supplies dwindle. Withdrawals of freshwater from all sources are increasing and may be about double the 1970 rate by 2020. By 1975 the withdrawal of ground water had increased 70 percent over the 1970 rate, and accounted for 22 percent of total freshwater withdrawal. To meet projected water demands substantial increases in ground-water withdrawal must continue. The availability of and needs for ground water in the region vary largely because of the great variety of landforms, climate, and earth materials. More than one half the region is underlain by rock materials capable of yielding ground water to wells at moderate to large rates; major ground-water reservoirs exist in six extensive areas. The most significant current problems pertaining to these ground-water reservoirs are: (1) declining water levels and depletion of supply; (2) water-quality deterioration; (3) waterlogging; (4) inadequate information; and (5) competition for available supplies. In the future these same problems are expected to persist and generally worsen in most of the major reservoir areas. (Woodard-USGS)
W80-02928

GROUND-WATER LEVELS AND QUALITY DATA FOR GEORGIA, 1978,
Geological Survey, Doraville, GA. Water Resources Div.
J. S. Clarke, W. G. Hester, and M. P. O'Byrne.
Geological Survey open-file report 79-1290, August 1979. 94 p, 7 Ref.

Descriptors: *Georgia, *Groundwater, *Water levels, *Water quality, *Water wells, Well data, Water level fluctuations, Aquifers, Hydrographs, Saline water intrusion, Chlorides, Data collections.

Mean water levels in wells across Georgia were from 0.25 foot higher to 11.4 feet lower in 1978 than in 1977, and in some areas were the lowest on record. Water levels in the principal artesian aquifer underwent a long-term decline during the period 1969-78. In some areas water levels dropped more than 10 feet. Wells tapping the Clayton Limestone in the Albany area showed a long-term decline during the period 1969-78, and in some wells water levels dropped more than 20 feet. Water levels in the Cretaceous aquifer system showed little fluctuation during 1978; however, in a well located in Chattahoochee County, water levels declined 4.4 feet during 1969-78. In the Piedmont area mean water levels remained the same to 2.2 feet lower in 1978 than in 1977, and showed no long-term trend. Chloride concentrations in the principal artesian aquifer in the Savannah area remained stable and in the Brunswick area continued to rise during 1978. Daily mean water-level fluctuations and trends for 1978 and fluctuations of the monthly mean water level for the previous 10 years are shown in hydrographs of 33 selected observation wells in Georgia. Chloride concentrations in 11 wells in the Savannah and Brunswick areas are shown in graphs of monthly values over the previous 10 years. A short narrative explains fluctuations and trends in each of the hydrographs and chloride concentration graphs shown. (Woodard-USGS)
W80-02931

COMPUTER SIMULATION AND GEOHYDROLOGY OF A BASALT AQUIFER SYSTEM IN THE PULLMAN-MOSCOW BASIN, WASHINGTON AND IDAHO,
Geological Survey Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 6A.
W80-02935

2G. Water In Soils

THE INFLUENCE OF CANAL SEEPAGE ON GROUNDWATER IN LUGERT LAKE IRRIGATION AREA,
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
D. L. Nofziger, C. E. Rice, and Sarmud Mishu.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-134034, Price codes: A03 in paper copy, A01 in microfiche. Oklahoma Water Resources Research Institute, Oklahoma State University, Technical Completion Report, November, 1979. 32 p, 11 Fig, 3 Tab, 6 Ref, 2 Append. OWRT A-080-OKLA(1), 14-34-0001-9038.

Descriptors: *Canal seepage, Ponding, *Seepage meter, *Soil salinity, Drainage, Groundwater, *Water loss, Irrigation canals, Soil water.

Seepage from irrigation canals in the Lugert Lake Irrigation area has been considered a major contribution to the perched water table and to soil salinity problems in the area. This research was conducted to quantify water losses from the canals and to determine the influence of the water losses on the soil water. Seepage rates were measured by ponding for canals less than 4 m wide. The rates ranged from 0.35 to 0.78 cm/hr (0.13 to 0.44 ft3/sec/mi) for canals in regions with clay loam surface soils and from 1.09 to 1.24 cm/hr (0.33 to 0.48 ft3/sec/mi) for regions with sandy loam surface soils. Seepage rates for the large main canals were measured with seepage meters, but the method proved unreliable. Water losses for the main canals calculated from measured rates on smaller canals were 0.85 to 1.3 ft3/sec/mi for clay loam soils and 1.3 to 2.0 ft3/sec/mi for sandy loam soils. Water-table elevations in the vicinity of the canals increased 100 to 200 cm near the canals and 60 to 120 cm at distances greater than 100 m from the canals. The elevations increased rapidly soon after water was placed in the canals and decreased rapidly after the canals were emptied. Water losses from the smaller canals were sufficient to account for up to 50% of the observed change in water-table elevation in the surrounding soil. Water losses from the main canals accounted for up to 100% of the change in the water table elevations.
W80-02706

RANGELAND HYDROLOGY IN AUSTRALIA -- A BRIEF REVIEW,
Utah State Univ., Logan. Watershed Science Unit.
G. F. Gifford.
Australian Rangeland Journal, Vol 1, No 2, p 150-166, 1978. 147 Ref.

Descriptors: *Australia, *Hydrology, *Soil-water-plant relationships, *Ranges, Grasslands, Infiltration, Interception, Groundwater recharge, Stemflow, Throughfall, Evapotranspiration, Soil moisture, Range management, Grazing, Burning.

Australian rangelands, areas where rainfall is not sufficient for crop production, cover about 5,703,703 sq km. A review of published hydrology studies of these rangelands is presented with emphasis on surface waters. Hydrologic processes are quantified in both 'natural' and 'modified' rangeland plant communities. The review provides an overall picture of the various factors involved in the hydrologic cycle for the rangelands to aid in better rangeland management. Hydrologic factors reviewed include: precipitation patterns, interception, throughfall, stemflow, infiltration, soil moisture storage, groundwater recharge, and evapotranspiration. The kinds of rangeland discussed are high elevation rangelands, improved pasture vs forest, grasslands, shrubs, scrubland, and water repellent soils. Reference is made to various models of water use, soil moisture patterns, and productivity as related to soil moisture patterns. The impacts on water runoff and quality of vegetation modification, grazing, pasture improvement, transmission losses, small structures, winter harvesting, burning, and snowpack management are also covered. (Seigler - IPA)
W80-02745

WATER MOVEMENT IN A LAND TREATMENT SYSTEM OF WASTEWATER BY OVERLAND FLOW,
Army Terrestrial Sciences Center, Hanover, NH. Applied Research Branch.
Y. Nakano, R. A. Khalid, and W. H. Patrick, Jr.
Progress in Water Technology, Vol 11, No 4/5, p 185-206, 1979. 12 Fig, 5 Tab, 15 Ref.

Descriptors: *Sewage effluents, *Waste water disposal, *Soil water movement, On-site investigations, Model studies, Mathematical models, Shallow water, Overland flow, Infiltration, Evapotranspiration, Theoretical analysis, Equations, Hydraulic conductivity, Hydraulic properties, Soil water, Waste water treatment, Land treatment systems.

Water movement in an overland-flow land treatment system was studied experimentally and theoretically. A small-scale physical model was used to obtain experimental data. The theoretical analysis was based upon the shallow water equation for overland flow and the Darcy-Richards law for soil water flow. It was found that the water movement in the system was primarily controlled by the application rate, the friction slope, the slope angle, the hydraulic characteristics of soils, and the evapotranspiration. An approximate analytical solution to steady flow in the system was obtained. It was found that the rate of soil water flow was mainly determined by the saturated conductivity of soils and in less extent by the friction slope and the slope angle in the steady condition. A finite difference solution to non-steady flow was found satisfactory in simulating the experimental data. (Sims-ISWS)
W80-02853

PORE SIZE DISTRIBUTION, SUCTION AND HYSTERESIS IN UNSATURATED GROUNDWATER FLOW,
Nevada Univ. System, Reno. Water Resources Center.
C. M. Case, and A. Welch.
Journal of Hydrology, Vol 43, No 1/4, p 99-120, October 1979. 7 Fig, 33 Ref, 3 Append.

Descriptors: *Soil water, *Hysteresis, *Groundwater, *Groundwater movement, *Model studies, Mathematical models, Soil water movement, Flow, Unsaturated flow, Pores, Pore water, Soil moisture, Capillary water, Hydrology, Pore size distribution, Suction.

Formalism for calculating soil moisture suction via average relative humidity in the soil was reviewed and then extended via the concept of pore size distribution. Using an assumed form for pore size distribution and a form of the Kelvin equation for the vapor pressure of a fluid in a capillary allowed direct calculation of the capillary contribution to suction under certain idealized conditions. The change in suction with changes in the concentration of total dissolved solids was then examined via the difference between the pressure of vapor over a pure solvent and that over a solution and changes in surface tension that occur when impurities are dissolved in water. The pore size distribution and an assumed form of volume per pore/capillary were used to construct and calculate the degree of saturation theta sub s(r) where the assumption is made that all pores/capillaries in the sample under consideration up to radius r are filled and those having radii larger than r are dry. Later in the development it was shown how this initial assumption can be refined. Negative suction and the degree of saturation theta sub s were calculated as explicit functions of r and plotted as implicit functions of each other, thereby yielding one of the family of hysteresis loops appropriate to the current formalism. If r sub o is the value of r for which the pore size distribution curve has its peak, the value of r sub o for the wetting branch is larger than that for the drying branch, since the drying curve 'sees' smaller pores/capillaries on the average than does the wetting curve. The area enclosed by the hysteresis loop was calculated and represents the energy per unit volume lost to the formation on adsorbing and then desorbing moisture. (Sims-ISWS)
W80-02892

LEACHING OF POLLUTANTS FROM SANITARY LANDFILL MODELS,
Technion-Israel Inst. of Tech., Haifa.
For primary bibliographic entry see Field 5B.
W80-02905

ANOMALIES IN CATION CONCENTRATIONS DURING PERCOLATION OF SIMULATED EFFLUENT THROUGH SAND,
California Inst. of Tech., Pasadena.
For primary bibliographic entry see Field 5B.
W80-02906

THERMAL DIFFUSIVITY AND CONDUCTIVITY OF MOIST POROUS MEDIA,
Arkansas Univ., Fayetteville. Dept. of Chemical Engineering.
R. J. Parikh, J. A. Havens, and H. D. Scott.
Soil Science Society of America Journal, Vol 43, No 5, p 1050-1052, September-October 1979. 3 Fig, 5 Ref, 1 Append. OWRT A-039-ARK(2), A-042-ARK(1), 14-31-0001-6004.

Descriptors: *Porous media, *Moisture content, *Thermal conductivity, *Heat flow, Laboratory tests, Soils, Loam, Measurement, Numerical analysis, Model studies, Mathematical models, Heat, Temperature, Soil science, Thermal diffusivity.

An unsteady-state method was used to determine thermal diffusivities and conductivities of nominally 250 micrometer glass beads and a silt loam soil over a range of moisture contents. The thermal diffusivity of the beads was found to increase from 0.0013 sq cm/sec for dry beads to 0.003 sq cm/sec at 5% volumetric moisture content, but is only weakly affected by moisture contents greater than 5%. The thermal diffusivity of the silt loam soil increases from 0.0022 sq cm/sec for dry soil to 0.0042 sq cm/sec at 30% volumetric moisture content, above which it remains essentially constant with increasing moisture content. The thermal conductivities of both porous media increase with moisture content over the entire wetness range, the thermal conductivity of the glass beads increasing from 0.53 mcal/deg C/cm/sec to 1.97 mcal/deg C/cm/sec, and that of the silt loam soil from 0.57 mcal/deg C/cm/sec to 2.79 mcal/deg C/cm/sec. Measured thermal conductivities of the glass bead media were in excellent agreement with values calculated using deVries' method. (Sims-ISWS)
W80-02915

2H. Lakes

A FIELD STUDY OF THE PHYSICAL EFFECTS OF THERMAL DISCHARGES AT LA CYGNE LAKE, KANSAS,
Kansas Univ., Lawrence. Dept. of Chemical and Petroleum Engineering.
J. Wagner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-133135, Price codes: A04 in paper copy, A01 in microfiche. Ph.D. Thesis (1979). 678 p, 72 Fig, 26 Tab, 93 Ref, 11 Append. OWRT B-032-KAN(3).

Descriptors: *Temperature distributions, Three dimensional, *Powerplants, *Limnology, Effects, Thermal discharges, Water circulation, *La Cygne Lake(KS).

Field studies were conducted at La Cygne Lake (871 ha) in eastern Kansas in order to determine the physical effects of thermal discharges from an 840 Mw power generating station. The results cover three and one-half years of study, including periods before and after plant startup. Temperature measurements defined the seasonal variation in lake temperatures, which were dominated by local climatological conditions. Discharge of thermal effluents resulted in both vertical and horizontal temperature gradients. Detailed descriptions of the temperature distributions under several combinations of meteorological and plant operating conditions showed a different temperature distribution for each set of conditions. There was no 'typical' temperature distribution. In all cases lake temperatures were three dimensional and closely related to current velocities. Methods proposed in the literature for predicting temperature distributions in shallow lakes and cooling ponds were evaluated on the basis of field observations at La Cygne Lake. One-dimensional models formulated on an oversimplification of lake hydrodynamics were found to be inadequate for shallow lakes, such as La Cygne Lake, where both the flow field and temperature distributions vary in time and all three spatial dimensions. Combinations of one-dimensional models which attempt to account for the multidimensional nature of the system suffer the same limitations as the individual one-dimensional models.
W80-02703

EFFECTS OF WHOLE LAKE MIXING ON ALGAE, FISH, AND WATER QUALITY,
Oklahoma State Univ., Stillwater. School of Biological Sciences.
D. W. Toetz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-133200, Price codes: A04 in paper copy, A01 in microfiche. Oklahoma Water Resources Research Institute, Oklahoma State University, Technical Completion Report, November 1979. 46 p, 8 Fig, 16 Tab, 25 Ref. OWRT A-078-OKLA(1), 14-34-0001-9038.

Descriptors: *Reservoirs, *Artificial destratification, *Water quality, Algal biomass, Community metabolism, Oklahoma, Lakes, Mixing.

This report describes the effects of artificial mixing of two Oklahoma lakes with a downflow (Garton) pump on water quality, algal biomass, and community metabolism. Artificial pumping in Arbuckle Lake (951 ha), advanced the autumnal turnover, but never completely destratified the lake. Ammonia and BOD5 decreased in the epilimnion, while dissolved oxygen (DO) increased and sulfide (S-) declined in the hypolimnion. Near-bottom concentrations of Mn++ increased. Pumping did not change significantly the depth of the Secchi disc or algal biomass. Community metabolism data failed to confirm that artificial lake mixing changes the ecosystem from autotrophic to heterotropic. The Garton pump seldom produced completely isothermal conditions or isochemical concentrations of DO in Ham's Lake (41 ha) and no measurable change in water quality, but pumping decreased water clarity and increased algal biomass.
W80-02705

TEMPERATURE AND DISSOLVED OXYGEN DATA FOR LAKE ONTARIO, 1972 (IFYGL),
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
J. D. Boyd, and B. J. Eadie.
NOAA Technical Memorandum ERL GLERL-21, August 1978. 218 p, 1 Fig, 3 Tab, 2 Append.

Descriptors: *Lake Ontario, *Canada, *Dissolved oxygen, Dissolved oxygen analyzers, Instrumentation, Oxygen, Water temperature, Water sampling, Statistical methods, Data collections, Lakes, Great Lakes, Monitoring.

Dissolved oxygen profiles for Lake Ontario are presented. The data for the profiles were gathered in 1972 during the joint Canadian-United States International Field Year for the Great Lakes (IFYGL). An oceanographic research vessel, the U.S. RV Researcher, was furnished by the National Oceanic and Atmospheric Administration (NOAA) to gather the data. The Researcher was equiped with an electrobathy thermograph (EBT), a dissolved oxygen monitor (DOM), and a rosette multisampler array. The original data were edited, corrected, and averaged to produce the profiles. The profiles give temperature, dissolved oxygen, and oxygen percent saturation at up to 27 discrete depths. Latitude, longitude, location, and cruise number and the date are provided for the 105 locations sampled. A statistical data summary is presented along with the actual depth, temperature, dissolved oxygen, and percent saturating values for each available cruise and station combination used for the profiles. Data are available from the National Climatic Center, Ashville, North Carolina, on magnetic tape. (Seigler-IPA)
W80-02727

DISTRIBUTION OF PHYTOPLANKTON IN IOWA LAKES,
Environmental Monitoring and Support Lab., Las Vegas, NV. Monitoring Operations Div.
L. R. Williams, S. C. Hern, V. W. Lambou, F. A. Morris, and M. K. Morris.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 608, Price codes: A04 in paper copy, A01 in microfiche. Report No EPA-600/3-79-062, June 1979. 53 p, 34 Tab, 12 Ref, 2 Append.

Descriptors: *Phytoplankton, *Iowa, *Aquatic microbiology, *Eutrophication, Trophic level, Lake stages, Water pollution effects, Water quality, Sewage effluents, Water sampling, Diatoms, Algae, Microorganisms, Microscopy.

In 1974, 15 Iowa lakes were sampled as a part of the National Eutrophication Survey. Phytoplankton species and abundance were determined in an effort to establish the relationship between algae characteristics and lake trophic status. The lakes sampled: (1) were all impacted by one or more sewage treatment plant outfalls; (2) were 40 hectares or larger; and (3) had a mean hydraulic retention rate of at least 30 days. Most lakes were sampled three times during the year at a site reflecting the deepest portion of each major basin in the lake. Depth-integrated samples to a depth of 15 feet or to the bottom were taken and shipped to the laboratory for analysis. Microscope slides were prepared and examined by several techniques to identify and count the phytoplankton. An overall

list of the phytoplankton in the 15 lakes is provided. All data collected are summarized by lake with an alphabetical phytoplankton species list with concentrations for individual species by sampling date. Results from the application of several indices (Nygaard's Trophic State, Palmer's Organic Pollution, and species diversity and abundance) are included. (Seigler-IPA)
W80-02731

DISTRIBUTION OF PHYTOPLANKTON IN KANSAS LAKES,
Environmental Monitoring and Support Lab., Las Vegas, NV. Monitoring Operations Div.
L. R. Williams, S. C. Hern, V. W. Lambou, F. A. Morris, and M. K. Morris.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 792, Price codes: A03 in paper copy, A01 in microfiche. Report No EPA-600/3-79-063, June 1979. 50 p, 34 Tab, 12 Ref, 2 Append.

Descriptors: *Phytoplankton, *Kansas, *Aquatic microbiology, *Eutrophication, Trophic level, Lake stages, Water pollution, Water pollution effects, Water quality, Sewage effluents, Water sampling, Diatoms, Algae, Microorganisms, Microscopy.

Fifteen Kansas lakes were sampled in 1974 as a part of the National Eutrophication Survey. Phytoplankton species and abundance data were collected in an effort to determine the relationships between algae characteristics and lake trophic status. The lakes selected for the survey had actual or potential accelerated eutrophication problems, and: (1) were impacted by one or more municipal sewage treatment plant outfalls, (2) were 40 hectares or larger, and (3) had a mean hydraulic retention time of at least 30 days. Major lake basins were sampled three times during the year. A depth-integrated phytoplankton sample was taken at each site. Samples were preserved, concentrated, and slides were prepared. Various microscope techniques were used to identify and count the phytoplankton. A general overall phytoplankton list is provided for the 15 lakes. All of the data are also summarized by lake including an alphabetical species given by sampling date. Results from the application of several indices, (Nygaard's Trophic State, Palmer's Organic Pollution, and species diversity and abundance) are also presented. (Seigler-IPA)
W80-02732

DISTRIBUTION OF PHYTOPLANKTON IN NEBRASKA LAKES,
Nevada Univ. Las Vegas. Dept. of Biological Sciences.
F. A. Morris, M. K. Morris, W. D. Taylor, L. R. Williams, and S. C. Hern.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 794, Price codes: A03 in paper copy, A01 in microfiche. Report No EPA-600/3-79-066, June 1979. 37 p, 22 Tab, 12 Ref, 2 Append.

Descriptors: *Phytoplankton, *Nebraska, *Aquatic microbiology, *Eutrophication, Trophic level, Lake stages, Water pollution, Water pollution effects, Water quality, Sewage effluents, Water sampling, Diatoms, Algae, Microorganisms, Microscopy.

Species and abundance data for phytoplankton in nine Nebraska lakes sampled during the National Eutrophication Survey in 1974 are presented. Phytoplankton data were collected and analyzed in an effort to determine relationships between algae characteristics and lake trophic status. All lakes sampled had actual or potential accelerated eutrophication problems and: (1) were impacted by one or more municipal sewage treatment plant outfalls; (2) were 40 hectares or larger; and (3) had a mean hydraulic retention rate of at least 30 days. A depth integrated sample was taken at each site usually three times during the year. Samples were preserved, concentrated, and slides were made. Various microscopic techniques were used to identify and count the phytoplankton. An overall list is provided for the phytoplankton identified in the nine lakes. Data are also summarized by lake including an alphabetical species list with concentrations for individual species by sampling date. Results from the application of several indices (Nygaard's Tropic State, Palmer's Organic Pollution, and species diversity and abundance) are included. (Seigler-IPA)
W80-02733

DISTRIBUTION OF PHYTOPLANKTON IN OKLAHOMA LAKES,
Environmental Monitoring and Support Lab., Las Vegas, NV. Monitoring Operations Div.
S. C. Herns, V. W. Lambou, F. A. Morris, M. K. Morris, and W. D. Taylor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 796, Price codes: A04 in paper copy, A01 in microfiche. Report No EPA-600/3-79-068, June 1979. 55 p, 34 Tab, 12 Ref, 2 Append.

Descriptors: *Phytoplankton, *Oklahoma, *Aquatic microbiology, *Eutrophication, Trophic level, Lake stages, Water pollution, Water pollution effects, Water quality, Sewage effluents, Water sampling, Diatoms, Algae, Microorganisms, Microscopy.

Data are presented on the species and abundance of phytoplankton in 15 Oklahoma lakes. The lakes were sampled in 1974 as a part of the National Eutrophication Survey to determine the relationship between algal characteristics and lake trophic status. All lakes sampled had actual or potential accelerated eutrophication problems and: (1) were impacted by one or more municipal sewage treatment plant outfalls; (2) were 40 hectares or larger; and (3) had a mean hydraulic retention rate of at least 30 days. At each site a depth-integrated phytoplankton sample was taken. A lake was usually sampled three times during the year. Samples were concentrated and slides were made for microscopic examination. An overall phytoplankton list is provided for the 15 lakes. Data are summarized by lake including an alphabetical species list with concentrations for individual species by sampling date. Results from the application of several indices (Nygaard's Trophic State, Palmer's Organic Pollution, and species diversity and abundance) are included. (Seigler-IPA)
W80-02734

DISTRIBUTION OF PHYTOPLANKTON IN NORTH DAKOTA LAKES,
Environmental Monitoring and Support Lab., Las Vegas, NV. Monitoring Operations Div.
W. D. Taylor, L. R. Williams, S. C. Hern, V. W. Lambou, and F. A. Morris.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 795, Price codes: A03 in paper copy, A01 in microfiche. Report No EPA-600/3-79-067, June 1979. 48 p, 32 Tab, 12 Ref, 2 Append.

Descriptors: *Phytoplankton, *North Dakota, *Aquatic microbiology, *Eutrophication, Trophic level, Lake stages, Water pollution effects, Water quality, Sewage effluents, Water sampling, Diatoms, Algae, Microorganisms, Microscopy.

Species and abundance data for phytoplankton in 14 North Dakota lakes sampled during the National Eutrophication Survey in the spring, summer, and fall of 1974 are presented. Phytoplankton data were collected and analyzed in an effort to determine the relationship between algae characteristics and lake trophic status. All lakes selected for sampling: (1) were impacted by one or more municipal sewage treatment plant outfalls; (2) were 40 hectares or larger; and (3) had a mean hydraulic retention rate of at least 30 days. A depth-integrated phytoplankton sample was taken at the deepest portion of each major basin in lakes tested. Samples were preserved and concentrated and slides were made for microscope examination. A general overall phytoplankton list for the 14 lakes is presented. Also, data are summarized by lake including an alphabetical phytoplankton species list with concentrations for individual species by sampling date. Results from the application of several indices (Nyaard's Trophic State, Palmer's Organic Pollution, and species diversity and abundance) are included. (Seigler-IPA)
W80-02735

LAKE RESTORATION, PROCEEDINGS OF A NATIONAL CONFERENCE, AUGUST 22-24, 1978, MINNEAPOLIS, MINNESOTA.
Available from U.S. Government Printing Office, Washington, DC 20402, Stock No 055-001-01084-2, $4.50. Report No EPA 440/5-79-001, March 1979. 262 p, 2 Append.

Descriptors: *Water management(Applied), *Eutrophication, *Lakes, *Conferences, Lake stages, Phosphorus, Water quality control, Watersheds(Basins), Water treatment, Water pollution treatment, Federal Water Pollution Control Act, Watershed management, Government finance, Grants, Planning.

The practical application of lake restoration technology is discussed in the 32 papers presented at the conference. The U.S. Environmental Protection Agency's clean lakes program is the source of funding for much of the technological progress cited. The past, present, and future needs and goals of the program are presented. Major areas of subject matter covered are: (1) Federal, State, and local programs, (2) assessing the problem and alternative solutions, (3) in-lake treatments, and (4) state of the art research. (See W80-02774 thru W80-02805) (Seigler-IPA)
W80-02773

PUTTING OURSELVES IN OUR PLACE,
House of Representatives, Washington, D.C.
D. M. Fraser.
In: Lake Restoration, Report No EPA 440/5-79-001, p. 7-9. 1979.

Descriptors: *Lake stages, *Federal Water Pollution Control Act, Water quality control, Eutrophication, Legislation, Water pollution control, Lakes, Environmental effects, Algae.

The growing awareness of the need for actions and funding to protect the environment is discussed in terms of lake quality and restoration. The old American attitude that the environment needed to be subdued and molded to fit man's needs began to fade rapidly in the 1960s and a growing concern for the destruction of environment is replacing it. Minnesota, the 'Land of 10,000 Lakes' has been and still is a leader in its concern and actions in lake restoration. In 1971 a Clean Lakes Act was introduced by former Senator Mondale and in 1972 it became a part of the Federal Water Pollution Control Act Amendments. Congress authorized $300 million for 1972-1975 for the program to help states with lake restoration. However, very little of the money was ever made available. The current administration has requested $15 million for the program in 1979, but still more is needed. Since 1976, 73 lakes in 23 states have been aided by the program. Only a small start has been made with lake restoration, much more is needed in the form of grants and research and development to prevent the ecological death of many lakes. (See also W80-02773) (Seigler-IPA).
W80-02774

REGION V CLEAN LAKES PROGRAM,
Environmental Protection Agency, Chicago, IL. Region V.
C. H. Sutfin.
Report No EPA/ 440/5-79-001, In: Lake Restoration, p. 17-19, 1979.

Descriptors: *Lakes, *Water pollution, *Grants, Minnesota, Septic tanks, Sewage effluents, Dredging, Government supports, Eutrophication, Lake stages, Water quality, Phosphorus, Monitoring, Limnology.

Region V continues to be a leader with its Clean Lakes Program. Lake inventories for the area include results from 34,000 lakes or 36% of the national lake total for the 48 contiguous states. Lake surveys and classifications are expected to increase in frequency and intensity as closer rela-

tionships develop between performing agencies. Region V currently has 18 Environmental Protection Agency grants totaling $17.3 million. Of the projects, 71% are for watershed controls for urban or agricultural nonpoint source drainage. Program focus is predominantly on urban lakes, especially in Minnesota for the Twin Cities area. Dredging is the predominant technique used for correcting effects of past abusive land use practices. Although none of the 18 projects has yet produced sufficient data to measure its success, seven projects have shown some favorable results. Most notable are the White Clay and Mirror Lake projects both of which have produced beneficial results. The region is supplying additional manpower to provide pre-application assistance and program administration assistance. A handbook is being developed to assist communities in assessing the degree of lake pollution from septic tanks. (See also W80-02773) (Seigler-IPA)
W80-02776

APPLIED LIMNOLOGY IN THE STATE OF MAINE,
Maine Dept. of Environmental Protection, Augusta.
M. Scott.
Report No EPA 440/5-79-001, In: Lake Restoration, p 21-24, 1979 21 Ref.

Descriptors: *Maine, *Limnology, Eutrophication, Lake stages, Lakes, Phosphorus, Watersheds(Basins), Water quality, Monitoring, Model studies, Water chemisty, Water pollution control, Surveys.

Maine has 3,000 glaciated lakes with the deepest being Sebago Lake and the largest being Mosshead Lake. Most early limnology survey work was performed by the inland fisheries. In the 1970s, the Maine Department of Environmental Protection formed the Division of Lakes and Biological Studies to perform work in applied limnology. The Division has made continuing progress to protect and restore the lakes in Maine. Extensive laboratory studies were performed in nutrient limitation for whole lake situations, modeling, and nutrient budgets. Detailed monitoring of Maine's lakes was conducted by volunteers and substantial quantities of baseline limnological data were collected. Other accomplishments include the Haley Pond restoration project, a project funded through section 314 of the Federal Water Pollution Control Act, uses biological manipulation of a filter feeder to reduce Zooplankton numbers, and model development and utilization. Future efforts will focus on lake protection to prevent the need for lake restoration. More regulations are needed for: a total phosphate band in detergents, state legislation on section 314 funds, sediment and errosion control, water levels in reservoirs, forestry and agricultural practices, drainage areas, chemical usage, remote pond protection, and an expanded monitoring program. The establishment would help in meeting future goals in lake protection and restoration. (See also W80-02773) (Seigler-IPA)
W80-02777

ESTABLISHING A LAKE RESTORATION PROGRAM IN MINNESOTA,
Minnesota Pollution Control Agency, Roseville.
J. G. Schilling.
In: Lake Restoration, Report No EPA 440/5-79-001, p 41-42, 1979.

Descriptors: *Minnesota, *Lakes, *Water management(Applied), Water quality control, Administration, Urbanization, Agriculture, Eutrophication, Government supports, Tourism, Income, Freshwater, Environmental effects, Mining.

More funding and a coordinated lake restoration and protection program are needed for Minnesota's lakes. Minnesota has the largest number of freshwater lakes in the continental U.S. with 12,000 lakes larger than 10 acres in surface area. At present there is no coordinated program for lake management, protection, and restoration and water resources management is burdened with overlapping jurisdictions of various governmental bodies. Only about 2% of the State's budget goes for all expenditures related to the environment with all funds for lake protection coming out that 2%. It is estimated that each acre of surface water brings in $300 annually from tourist trade while only $40 per acre is spent annually to protect that acre of lake. There seems to have been little impact on the State level from the loss of productive lakes, however, effects on local economics are much more severe. Although little surveying and research has been done, it is expected that increasing pressure will be put on Minnesota's lakes by increased tourist trade, urbanization, expanding agricultural usage, and a developing mining industry. While some progress has been made in obtaining increased funding from State and Federal sources and in establishing a comprehensive water resources management program, much more is needed. (See also W80-02773) (Seigler-IPA)
W80-02781

INTERRELATIONSHIP OF THE CLEAN LAKES PROGRAM AND WATER QUALITY MANAGEMENT,
Environmental Protection Agency, Washington, DC. Water Planning Div.
J. A. Krivak.
In: Lake Restoration, Report No EPA 440/5-79-001, p 51-53, 1979.

Descriptors: *Water management(Applied), *Government supports, *Legislation, Lakes, Water quality control, Planning, Administration, South Carolina, South Dakota, Project planning, Federal government, Grants, Governmental interrelations, State governments.

An Environmental Protection Agency (EPA) analysis of 54 clean lake projects showed that about two-thirds of the projects are preventative and curative, while about one-third of the programs treat only the symptoms of lake problems and not the causes. About 24% of the projects has a high degree of coordination between project sponsor and State water quality management programs, 43% had a low degree of coordination, and 33% had almost no coordination. On the Federal level, high coordination indicating active participation by another Federal agency was found in 17% of the projects, low coordination in 20%, and no coordination in the rest of the projects. These results indicate that: (1) a clear set of objectives and priorities needs to be developed at the State level, (2) more emphasis is needed on preventative and curative restoration measures, (3) a comprehensive water quality management program is needed, and (4) all applicable programs in specific project areas need to be coordinated. New State/EPA agreements are expected to help with coordination. Also expected to help is section 208 of the Clean Water Act which can be used to initiate and manage projects. The Model Implementation Projects (MIP's), a series of projects with similar objectives to the clean lakes programs have resulted from 208 planning. Project examples are Broadway Lake in South Carolina and Lake Herman in South Dakota. Continued program integration is needed to provide more effective water quality management. (See also W80-02773) (Seigler-IPA)
W80-02784

MEASUREMENT AND USES OF HYDRAULIC AND NUTRIENT BUDGETS,
Ontario Ministry of the Environment, Rexdale.
W. A. Scheider, J. J. Moss, and P. J. Dillon.
In: Lake Restoration, Report No EPA 440/5-79-001, p 77-83, 1979. 6 Fig, 4 Tab, 24 Ref.

Descriptors: *Canada, *Model studies, *Hydraulic models, *Nutrients, Lakes, Lake stages, Eutrophication, Cycling nutrients, Phosphorus, Groundwater, Sedimentation, Runoff, Watersheds(Basins), Mathematical models, Evaporation, Evapotranspiration.

Lake assessment techniques for constructing nutrient and hydraulic lake budgets are described; Harp Lake in Ontario is used as an example. Hydraulic and nutrient budgets plus the physical characteristics of a lake must be determined in order to construct a mass balance model for lake management use in the control of eutrophication. Hydraulic budget development requires the collection of many samples by various methods to determine values for storage in watershed, precipitation, evapotranspiration, runoff, groundwater, storage in lake, evaporation, lake outflow and lake volume. A phosphorus budget model was used in the construction of the Harp Lake nutrient budget although other more complex models can be used. The change in phosphorus in lake phosphorus concentration with time was equated to the phosphorus input per unit lake volume less the phosphorus lost through outflow and sedimentation. Both hydraulic and phosphorus budgets for Harp Lake are summarized and various alternative calculation methods are discussed for each budget. (See also W80-02773) (Seigler-IPA)
W80-02789

ARTIFICIAL AERATION AS A LAKE RESTORATION TECHNIQUE,
Limnological Associates, San Diego, CA.
A. W. Fast.
In: Lake Restoration, Report No EPA 440/5-79-001, p 121-131, 1979. 16 Fig, 59 Ref.

Descriptors: *Aeration, *Dissolved oxygen, *Thermal stratification, *Hypolimnion, Limnology, Eutrophication, Water circulation, Upwelling, Mixing, Lakes, Aquatic algae, Nutrient removal, Agriculture, Nitrogen, Anaerobic conditions.

Artificial aeration, the direct addition of air or oxygen to lake water sometimes including water circulation, is mainly used as a restoration technique in lakes that are deep enough to stratify thermally. The two types of lake aeration systems are destratification and hypolimnetic. With destratification, air from a compressor is pumped into deep water where its release causes hypolimnetic water to upwell. This results in a mixing of water temperatures and oxygen content with both becoming more uniform throughout the lake. However, mixing is usually not complete which can result in algal growth problems. Hypolimnetic aeration provides aeration of the hypolimnetic wastes without mixing with surface wastes. These aeration methods include air injection, pure oxygen injection, and mechanical means. Both destratification and hypolimnetic methods can effectively reduce hydrogen sulfide, iron, manganese, and other conditions associated with anaerobisis. Aeration techniques are also being used in aquaculture. A floating fish rearing system has been developed to utilize hypolimnetic aeration and to produce low cost fish while reducing lake nutrient content. An important aeration drawback is the production of excessive nitrogen which can cause fish kills. A flow chart of the logical sequential steps in the decision making process for using artificial aeration is presented. (See also W80-02773) (Seigler-IPA)
W80-02794

LAKE RESTORATION BY DILUTION,
Washington Univ., Seattle. Dept. of Civil Engineering.
E. B. Welch.
In: Lake Restoration, Report No EPA 440/5-79-001, p 133-139, 1979. 11 Fig, 3 Tab, 9 Ref.

Descriptors: *Eutrophication, *Lake stages, *Washington, *Water management(Applied), Phosphorus, Chlorophyll, Algal control, Aquatic algae, Water quality control, Lakes, Lake sediments, Water pollution control, Water pollution treatment, Nutrients, Nutrient removal.

Dilution, the addition of large quantities of low-nutrient water to eutrophic lakes, is a relatively quick and predictable method of lake restoration. Dilution reduces both the concentration of nutrients and algal cells. The availability of large amounts of low-nutrient water is the main limitation on the use of dilution as a lake restoration technique. A simple continuity equation can be used to predict the short term nutrient reduction effects of dilution by large quantities of water. A term for sedimentation must be added for the prediction of long term changes from the addition of small quantities of low-nutrient water. Dilution was used for lake restoration at Moses Lake and Green Lake, both in the state of Washington. For

Moses Lake, dilution water came from the Columbia River. Moses Lake dilution resulted in a more than 50% improvement in phosphorus, chlorophyll a, and Secchi values. Long term dilution at a relatively low rate began in Green Lake in 1962. Green Lake results are excellent with a 90% decrease in chlorophyll a and a nearly fourfold increase in water clarity. Dilution is planned for Wapato Lake at Tacoma, Washington. Project costs are estimated at $70,000 to $75,000. Advantages of dilution are: (1) low cost when water is available, (2) immediate results, and (3) successful results when only moderate to high nutrient water is available. (See also W80-02773) (Seigler-IPA)
W80-02795

THE NEED FOR MORE BIOLOGY IN LAKE RESTORATION,
Minnesota Univ., Minneapolis. Limnological Research Center.
J. Shapiro.
In: Lake Restoration, Report No EPA 440/5-79-001, p 161-167, 1979. 8 Fig, 35 Ref.

Descriptors: *Eutrophication, *Biocontrol, *Biological treatment, Integrated control measures, Biological, Aquatic algae, Algal control, Plankton, Fish food organisms, Phosphorus, Nitrogen, Zooplankton, Chlorophyll, Lake Sediments, Fish, Carp.

Phosphorus loading has been almost the exclusive concern in lake restoration programs. This has led to a narrow view of lake eutrophication without the needed concern for important biological factors. The use of nonbiological data to determine phosphorus budgets does not consider the fact that aquatic organisms, both plant and animal, are capable of putting nutrients from sediments back into circulation. Nitrogen and other nutrients and organisms that feed on algae such as planktivorous fish and zooplankton all affect the algal concentration in lakes. Examples of the use of biological approaches to lake restoration include removal or elmination of sediment recycling organisms by either biological or mechanical means, manipulation of the planktivorous fish population, and direct alteration of algal populations. Algal population may be altered or shifted by adding carbon dioxide and/or lowering the pH. Many biological lake restoration techniques are inexpensive and relatively easy, however, care must be taken when dealing with biological relationships that are often not under control. (See also W80-02773) (Seigler-IPA)
W80-02798

PRELIMINARY FINDINGS OF MEDICAL LAKE RESTORATION,
Battelle-Pacific Northwest Lab., Richland, WA.
A. F. Gasperino, G. R. Keizer, and R. A. Soltero.
In: Lake Restoration, Report No EPA 440/5-79-001 p 209-214, 1979. 7 Fig, 3 Tab, 3 Ref.

Descriptors: *Chemical precipitation, *Eutrophication, *Aluminum, *Sulfates, Phosphorus, Water pollution control, Lakes, Lake stages, Washington, Nutrients, Aquatic algae, Phytoplankton, Dissolved oxygen, Chlorophyll.

Medical Lake, an alkaline eutrophic lake located 32 km southwest of Spokane, Washington, was treated with an application of aluminum sulfate (alum). Prior to treatment the lake exhibited large nuisance algal blooms and excessive nutrient concentration. The alum application was designed to restore the lake to a more usable state by reducing phosphorus and algal levels, increasing oxygen levels, and improving water clarity. Nutrient inactivation was the most cost-effective method for disrupting the phosphorus cycle. Lake water quality was monitored prior to, during, and after the alum application and results indicate that the treatment was highly successful. Monitoring will continue until spring of 1980. Positive results include a sixfold decrease in concentrations of total phosphate and total soluble phosphate, and seventeenfold decline in mean orthophosphate levels. (See also W80-02773) (Seigler-IPA)
W80-02804

LAKE REHABILITATION: A STATUS REPORT,
Wisconsin Univ., Madison. Dept. of Urban and Regional Planning.
S. M. Born.
Environmental Management, Vol 3, No 2, p 145-153, March 1979. 2 Fig, 2 Tab, 52 Ref.

Descriptors: *Lake rehabilitation, *Eutrophication, *Water quality, *Sedimentation, *Lakes, *Water management(Applied), Lake degradation, Resource management, Clean Lakes Act, Lake Washington(WA), Strategies, Natural resources, Water quality control, Water pollution.

The most prevalent lake degradation problems are the result of eutrophication and sedimentation; other problems are due to the addition of toxic substances and radio-activity and by man-made alterations. Lake rehabilitation activities have been centered in developed and populous countries in lake-rich parts of the world, particularly in Western Europe, Canada, and the United States. In the U.S. lake rehabilitation has been provided for by the Clean Lakes Act (Sec. 314, PL 92-500). There are two general approaches to rehabilitating lakes: (1) restricting the input of undesirable materials, and (2) employing in-lake controls for the removal or inactivation of undesirable materials. In-lake techniques that can be used to hasten the recovery of degraded lakes include dredging, nutrient inactivation/precipitation, and aeration and/or circulation. The Lake Washington, Seattle (WA) case represents one of the most conclusive and best documented lake rehabilitation experiences. The lake underwent rapid eutrophication due to the influx of sewage effluent beginning in 1941. Concern led to creation of a municipal sewerage authority in 1958; by 1972 the lake had been rehabilitated to pre-eutrophication conditions and it has continued to experience improved water quality. The most outstanding illustration of the potential for employing in-lake techniques in a comprehensive lake rehabilitation strategy is the restoration of Lake Trummen in Sweden. Most of the lake rehabilitation activities to date have dealt with eutrophication problems and have emphasized reducing nutrient loading, particularly phosphorous. (Iervolino-NC)
W80-02869

PERFORMANCE OF AN AXIAL FLOW PUMP FOR LAKE DESTRATIFICATION,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Engineering.
J. E. Garton, R. G. Strecker, and R. C. Summerfelt.
Reprint from Southeastern Association of Game and Fish Commissioners, Thirtieth Annual Conference, p 336-346, 1976. 9 Fig, 1 Tab, 27 Ref, OWRT A-028-OKLA(4), 14-31-001-3236.

Descriptors: *Lakes, *Destratification, *Oklahoma, *On-site tests, Water quality control, Pumping, Pumps, Equipment, Dissolved oxygen, Water quality, Biochemical oxygen demand, Testing procedures, Water temperature, Density, Hydrogen ion concentration, Turbidity, On-site data collections, Axial flow pump.

A propeller pump was operated for 120 days on a lake of 40 ha surface area in north-central Oklahoma in the summer of 1975 to accomplish artificial destratification. The pump created a downflow of well-oxygenated surface water by means of a 1.82 m diameter propeller located 1.8 m below the lake's surface. The pump produced a flow of 1.72 cu m/sec, equivalent to 12.9% of total lake volume per day, at 17 rpm with a 1.0 h.p. electric motor. Four days of pumping eliminated thermal stratification, raised the temperature of the hypolimnetic water 9.5C, but increased surface temperature less than 1C. Thereafter, the entire water column remained isothermal (27-29C) during the summer. Dissolved oxygen at 5 m increased from 0.2 to 4.3 mg/l after the first day of pumping; thereafter DO levels at 5 and 9 m depths were above levels observed in 1973 and 1974; in mid-July 100% of the lake's volume contained more than 5 mg/l DO. BOD levels averaged 2.3 mg/l before pumping but 1.2 mg/l after pumping began. Turbidity did not change substantially with pumping, but vertically the variation at 1, 5, and 9 m depths was reduced. (Humphreys-ISWS)
W80-02879

EFFECT OF BOTTOM CONDITIONS ON EUTROPHY OF IMPOUNDMENTS,
Illinois State Water Survey, Urbana.
D. P. Roseboom, R. L. Evans, W. Wang, T. A. Butts, and R. M. Twait.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-137649, Price codes: A04 in paper copy, A01 in microfiche. ISWS Circular 139, 1979. 58 p, 34 Fig, 13 Tab, 34 Ref.

Descriptors: *Impoundments, *Eutrophication, *Illinois, *On-site investigations, Benthos, Lakes, Water chemistry, Water quality, Sediments, Oxygen demand, Water properties, Testing procedures, Hydrogen ion concentration, Analytical techniques, Methodology, Dissolved oxygen, Alkalinity, Iron, Manganese, Phosphorus, Ammonia, Anaerobic conditions, On-site data collections, On-site tests, Sampling, Water temperature, Sediment oxygen demand.

Two man-made impoundments, Lakes Eureka and Canton in central Illinois, were studied to develop procedures for assessing behavior characteristics and thereby relative eutrophy of waters in man-made lakes. Likenesses and differences for the two lakes in productivity, water chemistry, and sediment oxygen demand were identified. Both lakes thermally stratify and maintain an anerobic zone in bottom strata for a 5-month period in summer; stratification is weak in the shallower Lake Eureka, but well-defined in Lake Canton. The rate of anerobic zone formation is greater in Lake Eureka, but the zone's extent from the bottom is less than in Lake Canton; overall, oxygen depletion conditions in Lake Canton are the most severe. The thermal stratification of the lakes is not a barrier to the extent the anerobic zone penetrates the overlying waters. Both lakes support blue-green algae blooms. The density of algae at Lake Canton exceeds that at Lake Eureka; however, alkalinity reductions at the surface indicate algal productivity of Lake Eureka exceeds that of Lake Canton by 30%, and alkalinity increases in the bottom waters indicate microbial activity in bottom muds in Lake Eureka exceeds that in Lake Canton by 44%. Differences in alkalinity between the surface and bottom waters in both lakes were significant. Nonetheless, higher total and dissolved phosphorus contents in Lake Canton bottom waters give that lake a greater potential for productivity. Significant quantities of iron and manganese (mainly Fe(++) and Mn(++) forms) are released from the bottom muds of both lakes during summer stagnation. Chlorine demand of bottom waters is greater than that in upper water layers in both lakes.
W80-02881

A STATISTICAL ANALYSIS OF THE SEDIMENT VOLUME ACCUMULATED IN RESERVOIRS,
Asian Inst. of Tech., Bankok (Thailand).
For primary bibliographic entry see Field 2J.
W80-02890

HYDRAULIC POTENTIAL IN LAKE MICHIGAN BOTTOM SEDIMENTS,
Illinois State Geological Survey, Urbana.
K. Cartwright, C. S. Hunt, G. M. Hughes, and R. D. Brower.
Journal of Hydrology, Vol 43, No 1/4, p 67-78, October 1979. 6 Fig, 1 Tab, 11 Ref.

Descriptors: *Hydraulic properties, *Lake sediments, *Groundwater potential, *Groundwater movement, *Lake Michigan, Potentiometers, Groundwater, On-site investigation, Sampling, Sediments, Lakes, Hydraulic gradient, Measurement, Water chemistry, Hydrology, Sedimentology, Limnology, Hydraulic potential.

The magnitude and direction of groundwater flux in the bottom sediments of Lake Michigan were deduced from measurements made during three

shipboard cruises between 1973 and 1975. These factors affect the geochemical environment of the sediments and therefore the distribution of trace elements reported to be present. The near-shore, sandy-bottom and fine-grained, soft, deep-lake sediments were investigated; areas of hard till or bedrock were not included in the study. Thirty-three piezometers were placed in near-shore sands in waters 5-15 m deep. The piezometers were placed an average of 3 m into the bottom sediment. Water levels from the piezometers averaged 0.6 cm above the lake level, equivalent to an upward hydraulic gradient of about 0.002 cm/cm. Water samples taken from the piezometers have a distinctly different chemical composition from that of the lake water. The total dissolved mineral content and hardness of the groundwater are about twice those of the lake water. Twenty-two hydraulic gradient measurements were made in the fine-grained soft deep-lake sediments in waters 48-140 m deep by using a differential-pressure transducer dropped into the sediments. These measurements show an upward gradient averaging 0.2 cm/cm. No chemical data were obtained for the groundwater in the deep-lake sediments. The results of this study indicated that the groundwater flux is upward through the bottom sediments into Lake Michigan and that there is a chemical change in the water near the water-sediment contact. (Sims-ISWS)
W80-02893

HYDROGEOLOGY OF GLACIAL-TERRAIN LAKES, WITH MANAGEMENT AND PLANNING APPLICATIONS,
Wisconsin Univ., Madison. Dept. of Urban and Regional Planning.
For primary bibliographic entry see Field 2A.
W80-02895

CONCENTRATIONS OF BENZO(A)PYRENE IN THE SEDIMENTS OF SIX WESTERN UNITED STATES LAKES,
Department of Energy, New York. Environmental Measurements Lab.
For primary bibliographic entry see Field 5B.
W80-02898

MATHEMATICAL MODELING OF VEGETATIVE IMPACTS FROM FLUCTUATING FLOOD POOLS,
Iowa State Univ., Ames. Dept. of Civil Engineering.
T. A. Austin, W. F. Riddle, and R. Q. Landers, Jr.
Water Resources Bulletin, Vol 15, No 5, p 1265-1280, October 1979. 9 Fig, 28 Ref, 1 Append. OWRT B-049-IA(3).

Descriptors: *Flood control, *Iowa, *Reservoir operation, *Vegetation effects, *Model studies, Mathematical models, Computer models, Reservoirs, Vegetation, Vegetation establishment, Flooding, Water levels, Water level fluctuations, Shores, Lakes, Biology, Shoreline vegetation, Vegetative succession.

A flood control reservoir protects valuable developments on the downstream floodplain by storing flood waters and releasing them at a rate that will reduce the downstream damage. The water surface level of the flood pool behind the dam can fluctuate considerably during the occurrence of a large magnitude flood causing severe impacts on shoreline vegetation and water based recreation facilities located in the flood pool. A mathematical simulation model describing shoreline vegetative succession in response to flooding was presented. Plant species were grouped into ecologically similar compartments. Differential equations describing compartment intrinsic growth, intraspecies competition, interspecies competition, and other growth limiting factors were solved numerically. The model was used to evaluate the impacts of various operating policies on plant succession for a new reservoir in Central Iowa. (Sims-ISWS)
W80-02916

2I. Water In Plants

AQUATIC PLANT HARVESTING AS A LAKE RESTORATION TECHNIQUE,
Michigan State Univ., East Lansing. Inst. of Water Research.
T. M. Burton, D. L. King, and J. L. Ervin.
In: Lake Restoration, Report No EPA 440/5-79-001, p 177-185, 1979. 1 Fig, 3 Tab, 86 Ref.

Descriptors: *Aquatic plants, *Harvesting, *Eutrophication, Biomass, Aquatic algae, Dissolved oxygen, Evapotranspiration, Lake sediments, Phosphorus, Nitrogen, Light penetration, Aquatic environment, Floating plants, Aquatic productivity, Lake stages, Recreation.

The potential of aquatic plant harvest for nutrient removal depends largely on nutrient loading levels. Loading levels must be low for plant harvesting to be a successful technique for lake restoration, however, it does provide recreation and fishing benefits. For a typical eutrophic northern U.S. lake, a plant harvest will remove 1.5g to 12g of N/sq m/yr while in a southern U.S. lake it will remove 4.5g to 19.5g of N/sq m/yr. The floating species such as hyacinths and duckweed are capable of producing larger harvests. An estimation of nutrient removal by a plant harvest can be calculated by estimating the known point source loading and the non-point source loading along with the density of harvestable macrophytes. Macrophyte density can be determine from aerial photographs and ground truth data. These values can then be used in an equation to determine whether or not a harvest will remove more phosphorus and nitrogen than is being added to the lake. Environmental impacts of plant harvesting include resuspension of surficial sediments, exudation from severed macrophytes, leaching from floating severed stems, increased light penetration, decreased evapotranspiration, increased erosion of the littoral zone, phytoplankton blooms, and changes in dissolved oxygen, sediment, and the general biotic community. Harvesting costs vary widely but are usually in the $200 to $300 per hectare range. (See also W80-02773) (Seigler-IPA)
W80-02800

2J. Erosion and Sedimentation

POTENTIAL OF PALYGORSKITE AS A SEDIMENT TRACER,
Georgia Univ., Athens. Dept. of Geology.
R. E. Carver, and L. S. French.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-134331, Price codes: A03 in paper copy, A01 in microfiche. Environmental Resources Center Georgia Institute of Technology Atlanta, Report No ERC 05-79, May 1979. 30 p, 10 Fig, 5 Tab. OWRT B-133-GA(1), 14-34-0001-8075.

Descriptors: Water pollution, Soil erosion, *Sediment yield, *Tagging, *Sediment transport, Tracking techniques, Clays, *Palygorskite.

The object was to determine the potential of palygorskite as a sediment tracer. Soil samples from road cuts, construction sites, and borrow pits were analyzed for the size distribution and mineralogy of the fine fraction. The fine fraction was concentrated by wet sieving, and by removal of iron oxides and organic matter. The iron-oxide-free, organic-matter-free fine fraction (the clean fine fraction) ranged from 17.3 to 41.8 percent of the original weight of the five samples studied in detail. Palygorskite detection limits were determined by doping samples of clean fine fraction with 1, 5, 10, and 20 percent palygorskite (70 percent pure) and running X-ray diffractograms. One percent palygorskite was detectable in all samples, and 0.2 to 0.4 percent palygorskite in the original sample should be detectable in the clean fine fraction of the sample. Palygorskite appears to have excellent potential as a sediment tracer.
W80-02762

DREDGING AND LAKE RESTORATION,
Corvallis Environmental Research Lab., OR.
S. A. Peterson.
In: Lake Restoration, Report No EPA 440/5-79-001, p 105-144, 1979. 10 Fig, 4 Tab, 26 Ref.

Descriptors: *Dredging, *Eutrophication, *Lake sediments, Colloids, Desilting, Lakes, Lake basins, Lake beds, Watersheds(Basins), Lake stages, Bottom sediments, Nutrients, Dissolved oxygen, Toxins, Water temperature.

Of the techniques being used for lake restoration, dredging is the only one that directly removes the products of degredation (sediment) from the lake. It deepens the lake, removes recyclable nutrients, and returns the sediment to the watershed. Environmental concerns associated with dredging include resuspension of bottom sediments, toxic substances, oxygen depletion, reduced primary production, temperature alteration, increased nutrient levels, benthic community alteration, and sediment disposal sites. Negative and positive aspects are discussed for various types of dredging equipment including grab, bucket, clamshell, cutterhead, and specialized dredges such as mud cat, bucket wheel, and Japanese special purpose dredges. Results from dredging projects in several lakes are also discussed. Dredging costs are difficult to accurately determine because they depend on (1) the types and quantity of sediment to be removed, (2) type of dredges used, (3) the nature of the operational environment, and (4) the geographic location and method of material disposal. Corps of Engineer average dredging costs are presented for the various U.S. geographical areas. (See also W80-02773) (Seigler-IPA)
W80-02792

PHYSICAL AND CHEMICAL TREATMENT OF LAKE SEDIMENTS,
Notre Dame Univ., IN. Dept. of Civil Engineering.
T. L. Theis.
In: Lake Restoration, Report No EPA 440/5-79-001, p 115-120, 1979. 9 Fig, 1 Tab, 20 Ref.

Descriptors: *Eutrophication, *Lake sediments, *Phosphorus, *Cycling nutrients, Lakes, Lake stages, Bottom sediments, Salts, Sands, Dredging, Clays, Linings, Aeration, Fly ash.

The treatment of lake sediments by physical or chemical means is sometimes the best solution in eutrophic lakes experiencing slow recovery following the control of external nutrient sources. All sediment treatment techniques are designed to increase the role of sediments as nutrient (phosphorus) sinks and decrease their role as sources. Physical sediment treatments designed to cover sediments include physical liners, sand, and clay. Physical liners are usually a flexible plastic lining placed over sediments to prevent sediments from diffusing into the water. This method has been used in small reservoirs and lagoons, but its use on a large area is questionable as is its permanence and effect on benthic organisms. Sand is widely used due to its low cost, however, it does not provide a diffusion barrier. The use of layers of clay is promising, but clay has not yet been tested in lakes. Dredging, also a physical treatment, is effective but expensive. Dredging also often causes considerable deleterious environmental effects. Chemical treatment, the addition of chemical salts to sediments, alters sediment chemistry and increases those reactions that trap nutrients. Chemical treatment drawbacks include high chemical costs and the need for annual treatment. Fly ash shows promise as a treatment agent that can combine the benefits of both physical and chemical treatment. Hypolimnetic aeration, while not normally considered a sediment treatment can also reduce phosphate release rates. (See also W80-02773) (Seigler-IPA)
W80-02793

LAKE COCHRANE PERIMETER ROAD-SEDIMENT TRAPS RESTORATION PROJECT,
East Dakota Conservatory Sub-District, Brookings, SD.
J. L. Siegel.
In: Lake Restoration, Report No EPA 440/5-79-001, p 205-207, 1979. 3 Fig, 1 Tab, 3 Ref.

Descriptors: *Sediment control, *Multiple-purpose projects, *Suspended solids, South Dakota, Sedimentation, Eutrophication, Aquatic algae, Boat-launching ramps, Road construction, Fish management, Lakes, Lake stages, Lake sediments, Nutrients, Watersheds(Basins).

Lake Cochrane is one of the top 10 lakes in northeastern South Dakota. It is a high quality deep lake with intermittent surface water inflow, very infrequent surface outflow, and moderate groundwater recharge. An algal bloom in 1971 indicated that sediment nutrient inflow from three small drainage areas was adversely affecting the lake. An Environmental Protection Agency clean lakes grant was used to fund the construction of sediment traps as a part of the lake's perimeter road system. Features of the $35,000 multi-purpose project are: (1) 2,700 feet of gravel road to complete the perimeter road system; (2) three sediment traps to reduce inflow from 66% of the total dried drainage area; (3) a new boat access area; and (4) multi-purpose use of two of the traps as fish rearing ponds. Samples collected during the 1977 spring runoff indicated about an 80% removal of suspended solids by the sediment traps. Due to limited data collection and the concurrent impact of home construction around the lake, it is not possible to draw definite conclusions about the impacts of the project. (See also W80-02773) (Seigler-IPA)
W80-02803

A COMPARISON OF ELECTRONIC AND PIPET METHODS FOR MECHANICAL ANALYSIS OF SOILS,
Idaho Univ., Moscow. Dept. of Plant and Soil Sciences.
For primary bibliographic entry see Field 8D.
W80-02862

A STATISTICAL ANALYSIS OF THE SEDIMENT VOLUME ACCUMULATED IN RESERVOIRS,
Asian Inst. of Tech., Bankok (Thailand).
H. N. Phien, and A. Arbhabhrirama.
Journal of Hydrology, Vol 44, No 3/4, p 231-240, December 1979. 12 Ref.

Descriptors: *Sedimentation, *Reservoirs, *Reservoir silting, Reservoir storage, Dead storage, Statistical methods, Trap efficiency, Hydrology, Sediment discharge, Sediment trap efficiency.

A statistical method was used to investigate the reservoir sedimentation problem by: (1) correlating the annual sediment discharge and the annual river discharge; (2) using the resulting correlation either to generate a sediment sequence having the same length as the river discharge, or to obtain the distribution of the sediment discharge by means of a transformation of variable; and (3) expressing the accumulated volume as the cumulative sum of a sequence of random variables. Assuming a reservoir trap efficiency equal to unity, this cumulative sum is the partial sum of annual sediment discharges. The investigation then concentrated on the derivation of the mean and variance of the sediment volume accumulated in the design lifetime of the reservoir. (Lee-ISWS)
W80-02890

ON THE ORIGIN AND CHARACTERISTICS OF RIVER CHANNEL PATTERNS,
Sheffield Univ. (England). Dept. of Landscape Architecture.
For primary bibliographic entry see Field 2E.
W80-02891

HYDRAULIC POTENTIAL IN LAKE MICHIGAN BOTTOM SEDIMENTS,
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 2H.
W80-02893

OBSERVATIONS OF CONTEMPORARY ARROYO CUTTING NEAR SANTA FE, NEW MEXICO, U.S.A.
Geological Survey, Denver, CO. Geologic Div.; and Geological Survey, Reston, VA. Water Resources Div.
H. E. Malde, and A. G. Scott.
Earth Surface Processes, Vol 2, p 39-54, 1977. 13 Fig, 1 Tab, 16 Ref.

Descriptors: *Arroyos, *Channel erosion, *Rainfall-runoff relationships, *Semiarid climates, *New Mexico, Monitoring, *Arroyo cutting, *Santa Fe area(N Mex).

Arroyo cutting that began in the American Southwest in the 1880s is associated with sudden runoff, a circumstance characteristic of this semiarid region in which occasional intense rainfall exceeds the capacity of the ground to absorb water. This report describes two arroyos in an area of moderately dissected bolson deposits southwest of Santa Fe, Canada de la Cueva and Pueblo Canon, where arroyo cutting since 1970 has been closely related to runoff from summer rain. The area is vegetated chiefly by grama grass and scattered juniper. Cutting is monitored by repeated surveys of channel floors, cross-sections, and headcuts, and by repeated photographs taken as stereopairs. Rainfall and discharge are measured simultaneously in 5-minute intervals by dual digital recorders at a gauging station on Canada de la Cueva (drainage area 4.64 square kilometers). Discharge has been as much as 18.2 cubic meters per second from rainfall of 25.2 millimeters. (Woodard-USGS)
W80-02932

2K. Chemical Processes

AN ANOMALOUS OCCURRENCE OF SODIUM BICARBONATE WATER IN A FLOOD PLAIN IN A CARBONATE TERRANE,
Indiana Univ. at Bloomington. Dept. of Geology.
N. C. Krothe, and R. R. Parizek.
Ground Water, Vol 17, No 6, p 595-603, November-December 1979. 6 Fig, 4 Tab, 8 Ref, OWRT A-005-PA(10).

Descriptors: *Water chemistry, *Streams, *Sediments, *Pennsylvania, Soil water, Sodium compounds, Calcium, Magnesium, Potassium, Sampling, Chemical analysis, Flood plains, Chemistry, Sodium bicarbonate.

Geochemical factors controlling water chemistry in an influent stream and adjacent flooplain sediments were determined during a four-year study. The stream has a drainage basin that is similar to many streams draining carbonate terranes in the eastern United States. The stream receives sewage effluent and farm and urban runoff and supplies recharge to an aquifer under extensive development. Water beneath the floodplain, springs, and channel were calcium bicarbonate as expected; however, the prevalent chemical character of soil water beneath the channel was sodium bicarbonate. HC03(-) within soil water beneath the stream is three times (1,500 mg/l) that beneath the floodplain, Na(+) is two orders of magnitude greater (400 mg/l), K(+) reaches 10 mg/l, which is twice as great, while Ca(2+) and Mg(2+) may be 1/5 as high as concentrations beneath the floodplain, with ranges from 15 to 20 mg/l and 5 to 10 mg/l, respectively. Waters 3 to 7 feet below the floodplain contain intermediate Na(+) values from 25 to 75 mg/l. Ion exchange appears to be the mechanism accounting for the sodium bicarbonate water observed under the channel. The same relationship should occur in other areas with available carbonate rock, base exchange minerals, and an organic source. (Sims-ISWS)
W80-02880

EFFECT OF BOTTOM CONDITIONS ON EUTROPHY OF IMPOUNDMENTS,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2H.
W80-02881

ERROR ANALYSIS APPLIED TO INDIRECT METHODS FOR PRECIPITATION ACIDITY,
California Inst. of Tech., Pasadena. Dept. of Environmental Engineering Sciences.
H. M. Liljestrand, and J. J. Morgan.
Tellus, Vol 31, No 5, p 421-431, October 1979. 10 Fig, 31 Ref.

Descriptors: *Precipitation(Atmospheric), *Acidity, *Rain water, *Water chemistry, Chemistry of precipitation, Rainfall, Hydrogen ion concentration, Ions, Cations, Chemicals, Conductivity, Data processing, Analytical techniques, Acid precipitation, Rainfall acidity; Indirect methods, Error analysis.

The historical increase in the acidity of precipitation in northern Europe has been monitored by direct measurements of pH and titrations of acidity. Indirect methods such as conductivity and charge balances as well as chemical source models have been used to confirm the measured acidities. In the absence of historical records of direct measurements of acidity in precipitation in the United States, indirect methods have been applied to available data on the composition of rainwater to quantify the acidity. Unfortunately, the indirect methods are sensitive to small errors in certain pH regions. The effects of random errors in major ion concentrations as well as the systematic errors due to the exclusion of trace metal and organic ions were shown to be largest around pH 5.6 in the charge balance and chemical source strength calculations and largest around pH 6.1 for the conductivity balance method. Estimates of the uncertainty in historical mean values of precipitation ion concentrations were used to calculate upper and lower bounds on the acidity of rainwater in the United States before 1970. The trend of increasing acidity of precipitation in the northeastern United States is still evident after applying error analysis. (Sims-ISWS)
W80-02887

A FLOW PATTERN DEDUCED FROM URANIUM DISEQUILIBRIUM STUDIES FOR THE CENOMANIAN CARBONATE AQUIFER OF THE BEERSHEVA REGION, ISRAEL,
Tel Aviv Univ., (Israel). Dept. of Geophysics and Planetary Sciences.
For primary bibliographic entry see Field 2F.
W80-02889

GROUND-WATER LEVELS AND QUALITY DATA FOR GEORGIA, 1978,
Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W80-02931

2L. Estuaries

FINITE ELEMENT MODEL OF 2-D STRATIFIED FLOW,
Rosensteil School of Marine and Atmospheric Science, Miami, FL.
J. D. Wang.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY12, Proceedings Paper 15049, p 1473-1485, December 1979. 9 Fig, 11 Ref, 2 Append, NSF ENG-77-06437.

Descriptors: *Estuaries, *Salinity, *Finite element analysis, *Mathematical models, *Saline water intrusion, Dispersion, Stratified flow, Fluid mechanics, Analytical techniques, Open channel flow, Velocity, Rivers.

A finite element model for the study of hydrodynamics and salt transport in partially-mixed estuaries was presented. The model is based on the laterally integrated time varying equations of motion, continuity, and conservation of salt. The Boussinesq approximation was applied to the resulting two-dimensional equations, and a simple equation of state was used to relate salinity to density. Although a rigorous mathematical proof cannot be given, it was heuristically postulated that the correct boundary conditions, defining a well-posed problem, must consist of applied stresses or strain rates in cases which include internal (Reynolds) stresses. Without the internal stresses, the pressure

or the normal strain rate only can be prescribed. A simple application demonstrated the ability of this model to accurately represent the moving surface. Another example illustrated the significance of ocean boundary conditions on the internal solution. (Adams-ISWS)
W80-02911

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3B. Water Yield Improvement

NORTH AMERICAN WATER TRANSFERS: AN OVERVIEW,
Biswas and Associates, Ottawa (Ontario).
For primary bibliographic entry see Field 6E.
W80-02870

3C. Use Of Water Of Impaired Quality

THE ATTITUDES OF INDUSTRY AND PUBLIC OFFICIALS ON INDUSTRIAL USE OF RECLAIMED MUNICIPAL WASTEWATER EFFLUENT IN MASSACHUSETTS,
Massachusetts Univ., Amherst. Dept. of Plant and Soil Sciences.
J. Pratte, and W. Litsky.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-133606, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Center, University of Massachusetts, Publication No 106, 1979. 82 p, 1 Fig, 10 Tab, 43 Ref, 4 Append. OWRT A-114-MASS(1), 14-34-0001-9023.

Descriptors: *Water reuse, *Water conservation, *Industrial water, *Attitudes, Massachusetts, Waste water.

A study was initiated to assess the acceptance and capability of renovated wastewater supplying water to certain Massachusetts industries. The investigation was to determine if wastewater reuse by industry was a suitable water conservation measure in terms of social, economic, institutional and technological feasibility. Personal interviews, guided by a questionnaire, were held with industrial and public sector individuals. The results indicated that industry is more accepting of wastewater reuse than water resource officials if a project is cost-effective. Although there are few suitable industrial recipients of reclaimed water in Massachusetts, the concept is worthy of more attention as water costs increase, sewage treatment plants are upgraded and alternative water supplies are sought. (Godfrey-Mass)
W80-02707

WATER REUSE AND RECYCLING VOLUME 2: EVALUATION OF TREATMENT TECHNOLOGY.
Culp/Wesner/Culp, El Dorado Hills, CA.
For primary bibliographic entry see Field 5D.
W80-02711

SECONDARY SALINIZATION AND SODICATION IN EGYPT: A CASE STUDY,
Alexandria Univ. (Egypt).
For primary bibliographic entry see Field 5G.
W80-02858

3D. Conservation In Domestic and Municipal Use

TURNING 'WASTE' WATER INTO 'NEW' WATER,
L. Freeman.
Water, No 28, p 19-20, September 1979. 1 Fig.

Descriptors: *United Kingdom, *Water delivery, *Pipes, *Leakage, *Water loss, Islands, Water supply, Pipelines, Water conservation, Water shortage, Frequency, Ultrasonics, Water conveyance, Water districts, Conduits, Water management(Applied).

New methods for leak detection are being used on the Isle of Wight in an attempt to provide an additional 5 megaliters of water to the already inadequate supply. The island has a water demand that doubles during the summer due to vacationers. It is estimated that currently 1/4 of the island's water supply is being wasted due to leakage. The Southern Water Authority is using Hydrotronics Limited, a specialist in highly technological leak location to assist in identification of problem areas for a four week trial period. Hydrotronics uses a mobile laboratory and a 'black box' which includes microphone signal amplifiers and oscillographs. The box can operate in any of three frequency bands to identify leak noises. The equipment is accurate enough to find a leak and to determine the size of the hole. Approximately 17 miles of water lines were examined during the 4 weeks and 11 leaks were found that were wasting about 169,000 gallons of water. Although the Hydrotronics equipment is too expensive for the Water Authority to purchase it is considered highly successful. It is hoped that the island will be able to use the equipment again to help reduce waste to its lowest possible level by April of 1981. (Seigler-IPA)
W80-02755

INCREASING WATER AND SEWER RATE SCHEDULES: A TOOL FOR CONSERVATION,
Washington Suburban Sanitary Commission, Hyattsville, MD.
R. S. McGarry, and J. M. Brusnighan.
Journal of the American Water Works Association, Vol 5, No 71, p 474-479, September 1979. 6 Tab.

Descriptors: *Water conservation, *Water rates, *Water consumption, *Water demand, *Water use, Water resources planning, Water quantity, Washington(DC), Rate structures, Building code, Surcharge, Water supply.

This article discusses how the Washington, D.C. Suburban Sanitary Commission (WSSC) began achieving the goal of water conservation by instituting increasing water and sewer rate schedules. Serving 1.2 million people in a 1,000 square mile section of Prince Georges and Montgomery Counties, MD, WSSC is an independent regional commission responsible for planning, financing and constructing water supply-sewer facilities for the area. Faced with projected growth in demand for nearby Potomac River water from 415 million gallons/day (mgd) in 1980 to 855 mgd in 2020, the Commission began its conservation program by revising the building code to require water-conserving toilets and pressure reducing water valves in all new construction and renovation. New water and sewer rates were levied which initially included an additional 20% surcharge during peak use months of June through September. Although residential customers comprise 91% of WSSC's users, they account for only 48% of water demand, and thus a differential rate structure imposing special rates on commercial users has resulted in some water savings. After new increased rates were imposed across the board, the summer surcharge was dropped. The new rates have resulted in an 8% drop in consumption for 1978 over 1977, although commercial consumption by large users remained unchanged. Unless these users begin to conserve, the rate schedules will again have to be restructured. (Arnold-NC)
W80-02857

3E. Conservation In Industry

INCREASING WATER AND SEWER RATE SCHEDULES: A TOOL FOR CONSERVATION,
Washington Suburban Sanitary Commission, Hyattsville, MD.
For primary bibliographic entry see Field 3D.
W80-02857

3F. Conservation In Agriculture

IRRIGATION WATER USE AND MANAGEMENT.
Interagency Task Force Report of the Department of Interior, the Department of Agriculture, and the Environmental Protection Agency, June 1979. 140 p, 24 Fig, 22 Tab, 62 Ref.

Descriptors: *Irrigation water, *Water loss, *Irrigation efficiency, *Water conservation, Return flow, Irrigation practices, Agriculture, Crop production, Evapotranspiration, Irrigation ditches, Water conveyance, Water management(Applied), Seepage, Water utilization.

Irrigation water use and management are assessed and recommendations for increased conservation and efficiency are presented. Agricultural irrigation accounts for 80% of all consumed water and it is this area that has the most potential for savings. It is estimated that up to $5 billion is needed to implement water conservation techniques in the next 30 years. This should result in 2 to 5 million acre-feet of water that will become available for other uses. Improvements are possible in the areas of reducing (1) seepage from conveyance systems, (2) on farm irrigation return flows, and (3) incidental water uses. It is recommended that the individual States organize site-specific studies so that the conservation measures can be implemented. Federal programs will provide technical and financial assistance. The individual States have expressed their position of retaining control of their water resources and that the newly proposed programs should not be considered a substitute for the currently ongoing programs. The recommendations included are consistent with the President's June 6, 1978 water policy statement. A glossary of irrigation terms used in the report is also presented. (Seigler - IPA)
W80-02743

SECONDARY SALINIZATION AND SODICATION IN EGYPT: A CASE STUDY,
Alexandria Univ. (Egypt).
For primary bibliographic entry see Field 5G.
W80-02858

ON-FARM WATER MANAGEMENT IMPROVEMENT PROGRAMS,
Water Management and Irrigation Technologies Research Inst., Cairo (Egypt).
M. Abu-Zeid.
Water Supply and Management, Vol 3, No 2, p 69-75, 1979.

Descriptors: *Water resources, *Irrigation, *Water management(Applied), *Farm management, *Nile River(Egypt), Administration, Farming, Irrigation practices, Decision-making, Economics, Assessment, Water demand, Food production, Farms.

Irrigation for agriculture is the most effective means for rapidly increasing crop production. Traditionally, development of irrigation systems has involved new projects or enlarging existing projects with emphasis on capital intensive components. Water management in agriculture involves manipulation of water in the production of food and fiber; it is how to use all available tools and resources to provide water for plant growth. There is a major need for improvement of existing systems in order to improve management for rapid increase in food production, improve return of investments for existing systems, reduce costly waterlogging and salinity problems, reduce need for large capital investments in new systems and to gain knowledge which can provide criteria for the development and management of other systems. Water management programs consist of several overlapping phases; the four most important are (1) priority problem identification; (2) search for problem solutions; (3) assessment of solutions; and (4) pilot project implementation. The essential components for each phase are farmer participation and involvement; communication and feedback between farmers and researchers; effective, interdisciplinary team collaboration; careful selection, training and evaluation of all personnel; institutions

developed to serve farmers; and monitoring and evaluation of all aspects and phases. As an example of a management program the author describes the Egyptian Water Use and Management Project which was needed because the Aswan High Dam modified the Nile River fluctuations which served as coordination for prior water management systems. (Iervolino-NC)
W80-02864

IRRIGATION MANAGEMENT FOR RIVER-SALINITY CONTROL,
Utah State Univ., Logan. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5G.
W80-02908

EVAPOTRANSPIRATION UNDER DEPLETING SOIL MOISTURE,
Kasetsart Univ., Bangkok (Thailand).
For primary bibliographic entry see Field 2D.
W80-02909

RETRACTING AGRICULTURAL IRRIGATION SPRINKLER,
P. Unruh.
U.S. Patent No 4,171,775, 6 p, 5 Fig, 9 Ref; Official Gazette of the United States Patent Office, Vol 987, No 4, p 865, October 23, 1979.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, *Application equipment, Irrigation practices, Irrigation efficiency, Irrigation operation and maintenance.

A retracting agricultural irrigation sprinkler is buried with its cylinder below ground so that its riser can extend above the ground for sprinkler irrigation of the adjacent ground. The principal parts which move during irrigation sprinkling, with the rotating sprinkler nozzle and the motor which drives it, are above the ground so that they are accessible for replacement without need for excavation down to the buried retraction cylinder. A seal is provided in the upper end of the buried cylinder so that dirt is prevented from penetrating into the cylinder during sprinkling, and during retraction of the riser, water is discharged at the seal to wash off the riser as it is drawn into the cylinder. A check valve prevents the entrance of ground water into the sprinkler system and its supply pipe when the sprinkler is not in use. (Sinha - OEIS)
W80-02997

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

MAXIMUM UTILIZATION OF WATER RESOURCES IN A PLANNED COMMUNITY: EXECUTIVE SUMMARY,
Rice Univ., Houston, TX. Dept. of Environmental Science and Engineering.
W. G. Characklis, F. J. Gaudet, F. L. Roe, and P. B. Bedient.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116205, Price codes: A08 in paper copy, A01 in microfiche. Report No EPA-600/2-79-050a, July 1979. 148 p, 42 Fig, 29 Tab, 62 Ref. 802433.

Descriptors: *Urban runoff, *Watersheds(Basins), *Texas, *Storm runoff, Water quality control, Urban drainage, Urbanization, Eutrophication, Hydrologic data, Model studies, Water sampling, Disinfection, Paving, Nutrients, Overland flow, Chemical analysis, Pesticides.

Seventeen storms were monitored in six watersheds in the Houston, Texas, area during 1975 and 1976 to evaluate the physical, chemical, and biological effects of the water management plan used for the Woodlands, an ecologically planned community. The Woodlands water management plan is designed to avoid adverse water quality and hydrologic effects caused by urbanization. A comprehensive sampling and analytical program was used that monitored various chemical parameters including nitrogen, phosphorous, dissolved oxygen, pH, specific conductance, and chlorinated hydrocarbons. Also monitored were indicator bacterial organisms and aquatic and edaphic algae. for stormwater runoff, disinfectant demand and algal bioassays were conducted. Using the relationships between stormwater runoff quality, land use, and runoff quantities, the Stormwater Management Model (SWMM) was expanded to allow for separate sewer systems, urbanization effects on base flows, economics of natural drainage systems, Kjeldahl nitrogen, nitrates, and phosphates for a natural drainage system. The model was then used to simulate stormwater runoff quality and quantity for watersheds. Extensive results on the Woodlands system and SWMM are provided including the following: The greatest producers of suspended solids and nutrient loads are urban watersheds, urban stormwater runoff contains higher bacterial concentrations than forested area runoff, excessive does of chlorine or ozone are required for effective stormwater runoff disinfection from an urban area, and lakes serve as effective traps for excessive sediments transported by construction site runoff. (Seigler-IPA)
W80-02724

THE WHITE CLAY LAKE MANAGEMENT PLAN,
Wisconsin Univ. Extension, Madison.
J. O. Peterson, F. W. Madison, and A. E. Peterson.
In: Lake Restoration, Report No EPA 440/5-79-001, p 215-219, 1979. 1 Fig, 4 Tab, 5 Ref.

Descriptors: *Agricultural runoff, *Agricultural watersheds, *Watershed management, Wisconsin, Watersheds(Basins), Lakes, Eutrophication, Water management(Applied), Dairy industry, Farms, Water pollution sources, Farm wastes, Phosphorus, Domestic animals, Nitrogen.

Agricultural operations in the 3,500 acre White Clay Lake Watershed were studied in 1973 to determine their effect on lake water quality. White Clay Lake, located in eastern Shawano County, Wisconsin, has little shore development to contribute to lake eutrophication. Study operations included: (1) flow monitoring of three watershed areas; (2) water sampling for residue, phosphorus, nitrogen, and chloride content; (3) a groundwater movement and quality survey; and (4) the collection of weather data from stations within the watershed. Following the study a Lake Protection District and management plan were developed to reduce the nutrient and sediment flow into the lake. The plan emphasizes the protection of the lake rather than its restoration. The most critical nonpoint source pollution problems were barnyards and feedlots. Use of initial funding from the Upper Great Lakes Regional Commission, the U.S. Environmental Protection Agency, and the Wisconsin Department of Natural Resources was directed at the critical problems. Conservation practices were also installed on watershed croplands. White Clay Lake is now considered to be of good quality, however, monitoring is continuing to determine the effect of the preventive measures. (See also W80-02773) (Seigler-IPA)
W80-02805

SPECIAL FLOOD HAZARD INFORMATION: WOLF CREEK, GRANADA, COLORADO.
Army Engineer District, Albuquerque, NM.
For primary bibliographic entry see Field 2E.
W80-02848

SPECIAL FLOOD HAZARD INFORMATION: ARKANSAS RIVER & TRIBUTARIES, GREAT BEND, KANSAS.
Army Engineer District, Albuquerque, NM.
For primary bibliographic entry see Field 2E.
W80-02849

SPECIAL FLOOD HAZARD INFORMATION: CLEARWATER CREEK, RICE CREEK WATERSHED, CENTERVILLE, LINO LAKES, HUGO, MINNESOTA.
Army Engineer District, St. Paul, MN.
For primary bibliographic entry see Field 2E.
W80-02850

SPECIAL FLOOD HAZARD INFORMATION: GYPSUM AND DRY CREEKS, WICHITA, KANSAS.
Army Engineer District, Tulsa, OK.
For primary bibliographic entry see Field 2E.
W80-02851

SPECIAL FLOOD HAZARD INFORMATION REPORT: SANDY LICK CREEK, CITY OF DUBOIS, CLEARFIELD COUNTY, PENNSYLVANIA.
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 2E.
W80-02852

SPECIAL FLOOD HAZARD INFORMATION: ARKANSAS RIVER, ANDERSON AND KING ARROYOS, LA JUNTA, OTERO COUNTY, CO.
Army Engineer District, Albuquerque, NM.
For primary bibliographic entry see Field 2E.
W80-02854

SPECIAL FLOOD HAZARD INFORMATION: CIBOLO CREEK, PRESIDIO & SHAFTER, TEXAS.
Army Engineer District, Albuquerque, NM.
For primary bibliographic entry see Field 2E.
W80-02855

EXPANDED FLOOD PLAIN INFORMATION STUDY: ROWLETT CREEK, DALLAS AND COLLIN COUNTIES, TEXAS.
Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 2E.
W80-02856

FLOOD HAZARD INFORMATION: SAN MARCOS AND BLANCO RIVERS, SAN MARCOS, TEXAS.
Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 2E.
W80-02872

FLOOD PLAIN INFORMATION: MISSOURI RIVER, BISMARCK-BURLEIGH COUNTY, NORTH DAKOTA.
Army Engineer District, Omaha, NE.
For primary bibliographic entry see Field 2E.
W80-02873

SYNTHETIC DRAIN ENVELOPE-SOIL INTERACTIONS,
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
For primary bibliographic entry see Field 4D.
W80-02907

METHOD FOR SIPHONING WATER FROM A PONDING AREA ON A FLAT ROOF,
D. W. Loftin.
U S Patent No 4,171,706, 7 p, 5 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 987, No 4, p 840, October 23, 1979.

Descriptors: *Patents, *Rain water, Roofs, Ponding, Water conveyance, *Siphons, *Water removal, Flat roofs.

A method for removing water from a ponding area of a flat roof having a run-off system which is not longer operable to drain water from the ponding area comprises directing a quantity of the run-off water flow as a result of the commencement of a rain condition or the like into a priming chamber. Run-off water is allowed to discharge into the run-off system at a rate less than the rate of flow of

run-off water into the priming chamber and effects a siphoning action. The quantity of run-off water flowing into the priming chamber is less than the quantity flowing out thereby lowering the water level within the priming chamber and creating a suction action which is utilized to commence the movement of the water in the ponding area through the siphon device hose. The movement continues until all of the water in the ponding area has been sucked up through the siphone hose. (Sinha - OEIS)
W80-02912

WATER ALLOCATION AND MANAGEMENT IN THE SOUTHEAST,
North Carolina State Univ. at Raleigh; and North Carolina Univ. at Chapel Hill.
D. H. Howells.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 105, No WR2, p 259-267, September 1979. 2 Ref. OWRT B-125-NC(5), 14-34-0001-8134.

Descriptors: *Water allocation(Policy), *Water management(Applied), *Water rights, *Water transfer, *Land management, Water resources, Diversion, Water law, Water control, Southeastern U.S.

Summarized are papers and presentations associated with the April 19-20, 1978 Southeast Conference on Legal and Administrative Systems for Water Allocation and Management held at the Virginia Polytechnic Institute and State University in Blacksburg, Va. Conclusions and recommendations developed at the conference included: the need for reexamination of existing legal and administrative systems for water allocation to meet emerging problems in most southeastern states; legislation to clarify water rights associated with diversion and interbasin transfer; recodification of existing water law; studies and proposals leading to improved state policies, law, and programs with respect to minimum streamflows, water shortages, hydrologic and land use relationships. Conference was also placed on the need for strengthened state water resources planning, management, and interstate cooperation. (Bell-Graf--Cornell)
W80-02917

DEVICE FOR SIPHONING WATER FROM A PONDING AREA ON A FLAT ROOF,
D. W. Loftin.
U.S. Patent No 4,171,709, 12 p, 8 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 987, No 4, p 841, October 23, 1979.

Descriptors: *Patents, *Rain water, Roofs, Ponding, *Siphons, Conveyance structures, Water conveyance, Equipment, *Water removal, Flat roofs.

An apparatus for removing water from a ponding area of a flat roof having a run-off system which is no longer operable to drain water comprises a structure for directing a quantity of the run-off water flowing as a result of the commencement of a rain condition or the like into a priming chamber. The structure for displacing water from the priming chamber back into the run-off system works in such a way as to establish a negative pressure condition within the priming chamber. The structure communicates the negative pressure condition to the end of a siphon hose at a vertical level below the level of the ponding area. The other end of the siphon hose is placed in water sucking relation to the ponding area to thereby prime the siphon hose and commence the flow of water. The water flow continues until the rain condition ceases or until the water is substantially removed from the ponding area. (Sinha - OEIS)
W80-02979

MAXIMUM UTILIZATION OF WATER RESOURCES IN A PLANNED COMMUNITY, STORM WATER RUNOFF QUALITY: DATA COLLECTION, REDUCTION AND ANALYSIS,
Rice Univ., Houston, TX. Dept. of Environmental Science and Engineering.
W. G. Characklis, F. J. Gaudet, F. L. Roe, and P. B. Bedient.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116213, Price codes: A06 in paper copy, A01 in microfiche. Report No EPA-600/2-79-050b, July 1979, 112 p, 28 Fig, 25 Tab, 27 Ref, 802433.

Descriptors: *Urban runoff, *Hydrologic data, *Texas, *Storm runoff, Urban drainage, Urban hydrology, Watersheds(Basins), Land use, Water quality, Water pollution sources, Overland flow, Water sampling, Sedimentation rates, Environmental effects, Data collection.

Storm water runoff quality was studied at several sites in the Houston, Texas, metropolitan area including the Woodlands, an ecologically planned community designed to utilize existing natural drainage while reducing adverse water quality and hydrologic effects resulting from urbanization. The Storm Water Management Model was used at the Woodlands to combine water quality and quantity data for design and management purposes. Features of the Woodlands include reclaimed waste water impoundments for dry weather irrigation and non-contact recreation and porous pavement to reduce runoff volumes. Water quality and quantity data were collected during both dry and storm conditions for the following parameters: organic carbon, biochemical oxygen demand, ammonia, nitrate, nitrite, total Kjeldahl nitrogen, orthophosphates, total phosphorus, dissolved oxygen, pH, turbidity, total suspended solids, and specific conductance. From the data, pollutant loads were predicted according to land use. Results show that total pollutant load-runoff relations are a function of land use activity in a watershed. It was found that man-made lakes do serve as effective traps for sediments from construction site runoff. Extensive results and conclusions are presented along with recommendations for continued assessment of the planned water resources system at the Woodlands. (Seigler-IPA)
W80-02996

4B. Groundwater Management

GROUND-WATER RESOURCES AND MODEL APPLICATIONS FOR THE EDWARDS (BALCONES FAULT ZONE) AQUIFER IN THE SAN ANTONIO REGION, TEXAS,
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 2F.
W80-02883

SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER RESOURCES--PACIFIC NORTHWEST REGION,
Geological Survey, Seattle, WA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W80-02928

4C. Effects On Water Of Man's Non-Water Activities

EFFECTIVE LOCAL AUTHORITY TO ENSURE LASTING LAKE RESTORATION AND PROTECTION,
Westlake Lake Management Association, CA.
F. Bigelow.
In: Lake Restoration, Report No EPA 440/5-79-001, p 33-38, 1979. 5 Ref.

Descriptors: *Water management(Applied), *Urban hydrology, *Administration, California, Community development, Planning, Lakes, Recreation, Eutrophication, Lake stages, Lake basins, Lake shores, Public rights, Insurance, Taxes, Operating costs, Operation and maintenance, Maintenance costs.

The management structure and methods of the Westlake Lake Management Association are outlined. The 150-acre lake was constructed in 1967 for a residential community. It drains 18 square miles of runoff, has 700 homes along the nine mile shoreline, and another 700 homes off the lake. A 33 member general board of directors elects a smaller executive board which meets monthly. The covenant, conditions, and restrictions (CG and R's) document, carefully drawn up to guide the management, requires a two-thirds majority vote of all home owners to change any rules. The CC & R's document spells out management policy and association rules in the areas of assessments for lake maintenance fees, construction of docks, landscaping and property maintenance, methods of enforcing violations, rights and obligations of homeowners, authority to hire a manager and staff, and various structural rules for the organization. Other problems of lake management discussed include tax exempt status, operating insurance, and communication with association members. Public meetings and a monthly newsletter with a question and answer section are suggested as ways to educate lake association members and to keep them aware of management actions. Other areas of special management consideration are lake maintenance, operation requirements, and watershed management. Effective planning to reduce and prevent unnecessary management and maintenance costs should involve exchanges of information with other lake associations, local, county, state, and Federal agencies, research centers, and universities. (See also W80-02773) (Seigler-IPA)
W80-02779

THE IMPACT OF SURFACE MINING ON THE HYDROLOGIC ENVIRONMENT OF THE BIG SANDY CREEK WATERSHED, FAYETTE COUNTY, PENNSYLVANIA,
Pennsylvania Dept. of Environmental Resources, Harrisburg.
K. K. Sheaffer.
In: Surface Mining and Fish/Wildlife Needs in the Eastern United States, Report No FWS/OBS-78/81 A, p 91-98, 1979. 2 Fig, 4 Tab, 2 Ref.

Descriptors: *Pennsylvania, *Coal mines, *Environmental effects, *Watershed management, Water sampling, Monitoring, Fish, Benthos, Alkalinity, Water temperature, Sediments, Rainfall, Iron, Specific conductivity, Dissolved oxygen, Stream gauges, Flow measurement.

Stony Fork, the major tributary of Big Sandy Creek, was monitored to establish a base for determining the effects of bituminous surface mining on the watershed. There are already three active surface mines in the watershed with much interest for expanded mining. Monitoring methods used include chemical, physical, and biological sampling on a continuous, weekly, monthly, and semi-annual sampling basis. Two surface water gauging stations continuously monitor stream flow quantity. Also monitored are pH, temperature, specific conductance, dissolved oxygen, rain amounts, sediment, suspended solids, alkalinity, acidity, total and dissolved iron, and total and dissolved levels of 14 metals. Sampling was performed quarterly for benthic macroinvertebrates and fish identification. Summaries of results are presented for March through September 1977. Overall results indicate that no measurable change has occurred in Stony Fork water quality. The data collected form a sufficient base for the evaluation of present and future bituminuous surface mining impacts. (Seigler-IPA)
W80-02809

POTENTIAL INTERACTIONS BETWEEN PIPELINES AND TERRAIN IN A NORTHERN ENVIRONMENT,
Department of the Environment, Ottawa (Ontario). Inland Waters in Directorate.
R. O. van Everdingen.
Ottawa, Ontario, Canada NHRI Paper No 8, 1979. 7 p, 1 Tab, 6 Ref.

Descriptors: *Pipelines, *Natural gas, *Construction, Terrain, Berm mode, Buried mode, Operation, Abandonment, Groundwater, Surface-water, Abandonment.

In a northern environment various interactions between pipelines and the terrain which they cross may produce adverse effects on pipeline integrity;

adverse effects on the environment may also result, either directly or as a consequence of the increased maintenance or repairs required. In any particular situation the interactions and the severity of their effects will depend on the pipeline construction mode (e.g. buried or above-ground) and operation mode (e.g. chilled or warm); on the distribution of frozen and nonfrozen ground; and on the relative sensitivity of the ground during freezing and/or thawing. Most of the interactions are related to the occurrence and movement of surface water and subsurface water or to the occurrence or formation of ice. A tabulation of possible interactions and effects is presented as a guide to the potential problems that may occur during the construction and operation, as well as after abandonment, of a pipeline. When recognized early enough, development of such problems can often be avoided by rerouting or prevented by special design measures. Early recognition can in most cases only be achieved through special studies on groundwater levels, flow rates and temperatures; on the occurrence of icings; and on the distribution and character of ground ice. (WATDOC)
W80-02833

4D. Watershed Protection

SYNTHETIC DRAIN ENVELOPE-SOIL INTERACTIONS,
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
L. S. Willardson, and R. E. Walker.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol 105, No IR4, Proceedings Paper 15028, p 367-373, December 1979. 2 Fig, 4 Tab, 7 Ref.

Descriptors: *Drainage, *Sediments, *Filters, Soil properties, Soil physics, Soil structure, Laboratory tests, Permeameters, Hydraulic gradient, Subsurface drainage, Tile drainage, Interfaces, Earth-water interfaces, Sedimentation, Sediment transport, Sediment control, Drain envelopes, Soil interactions.

Synthetic drain envelope materials currently available commercially have been found to be equally effective as drain envelopes. The materials function primarily as mechanical support for the soil-drain opening interface. Soils have a limited characteristic resistance to internal hydraulic gradients. Flows causing gradients in excess of the hydraulic failure gradient of the particular soil will result in failure of the soil structural skeleton and the drain envelope. (Sims-ISWS)
W80-02907

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

FISH BIOASSAY MONITORING OF WASTE EFFLUENTS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
W. H. Van Der Schalie, K. L. Dickson, G. F. Westlake, and J. Cairns.
Environmental Management, Vol 3, No 3, p 217-235, 1979. 5 Fig, 7 Tab, 68 Ref.

Descriptors: *Industrial wastes, *Bioassay, *Fish behavior, *Sunfishes, Virginia, Toxins, Respiration, Water pollution, Monitoring, Industrial water, Water pollution sources, Fish physiology, Chemical wastes, Waste water(Pollution).

An on-line evaluation of a computer-based fish monitoring system was conducted to determine the system's value in monitoring the toxicity of industrial waste effluents. Bluegills, Lepomis macrohirus Raf., were used in the study. The monitoring site was on the New River at Pearisburg, Virginia, at the Celanese Fibers Company's Celco Plant. At the site, plant wastes averaged 0.1% of the total river flow. The computerized system monitored the ventilation patterns of 12 bluegills in individual fiberglass tanks containing 30 liters of water. Electrical signals generated when a fish passes water over its gills were detected by stainless steel electrodes located at each end of a tank. Wastewater was passed into the tanks to simulate various conditions in eight experiments. A control fish was used for all experiments. One experiment included the simulation of an acetone spill. Many problems and inconsistencies were encountered due to environmental disturbances and system design problems, however, the technique shows much potential. Recommendations concerning the physical components and computer software for a second generation monitoring system are provided. A brief history of previously developed monitoring systems is also presented. (Seigler-IPA)
W80-02744

METHODS OF EVALUATION OF POTENTIALLY HAZARDOUS ORGANICS IN WATER,
Connecticut Univ., Storrs. Inst. of Water Resources.
R. P. Collins.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-135122, Price codes: A02 in paper copy, A01 in microfiche. Research Project Technical Completion Report, 1979. 13 p, 1 Tab, 11 Fig. OWRT A-072-CONN(1), 14-34-0001-8007.

Descriptors: *Gas chromatography, *Mass spectrometry, Water analysis, Analytical techniques, *Organic pollutants, Trace organic pollutants.

A method for 'fingerprinting' of public water supplies for the presence of trace organic pollutants has been devised. The procedure involves the trapping of organic compounds on Tenax GC columns, desorption of the compounds from the column and analysis by gas chromatography. A systematic procedure has also been devised for the characterization of trace organic pollutants in the Thames River. The process involves solvent extraction, separation into classes of organic compounds, and identification by means of gas chromatography and mass spectrometry. (Burke-Conn)
W80-02761

MUNICIPAL POLLUTANT LOADINGS TO THE GREAT LAKES FROM ONTARIO COMMUNITIES,
Environmental Protection Service, Ottawa (Ontario). Water Training and Technology Transfer Div.
D. H. Waller, and Z. Novak.
Canada-Ontario Agreement on Great Lakes Water Quality, Ottawa, Ontario, Canada, Research Report No 94, 1979. 40 p, 4 Fig, 17 Tab, 18 Ref, 75-8-33.

Descriptors: *Great Lakes, *Municipal wastes, *Water pollution, Pollutants, Sewage, Pollutant loads, Human population, Land use, Surface runoff, Ontario.

This report updates and extends previous estimates of total annual pollutant loads to the Great Lakes from Ontario communities. An improved method of estimating combined sewage loads is proposed and evaluated. (WATDOC)
W80-02832

WATER QUALITY INTERPRETIVE REPORT, ONTARIO, 1967-1977.
Water and Earth Science Associates Ltd., Ottawa (Ontario).
Available from Inland Waters Directorate, Environment Canada, Ottawa, Ontario, Canada, K1A OE7. Water Quality Interpretive Report No 3, 1979. 67 p, 17 Fig, 25 Tab, 17 Ref, 1 App.

Descriptors: *Water quality, *Water quality control,*Water treatment, *Potable water, Watersheds(Basins), Water types, Chemical analysis, Geochemistry, Data collections.

The chemical data for 27 watersheds in Ontario have been reviewed and interpreted. During the period 1967 to 1977, over 1600 samples were collected and chemically analysed for as many as 30 water quality parameters. The Ontario data base considered in this report contains more than 37000 data points. Analysis of the major ion chemistry indicated that most of the Ontario watersheds were alkaline-earth bicarbonate waters. Three were designated alkaline-earth bicarbonate/sulphate waters, and one was alkaline-earth sulphate water. Anthropogenic loadings were evident in six watersheds in the St. Lawrence Lowland region. These watersheds exhibited higher ionic proportions of both chloride and sulphate. Although no water quality assessment was possible for the protection of freshwater aquatic life, the extreme susceptibility of the Precambrian watersheds, especially the watersheds on the Laurentian Highlands, to environmental alteration was very evident. (WATDOC)
W80-02838

LEACHING OF POLLUTANTS FROM SANITARY LANDFILL MODELS,
Technion-Israel Inst. of Tech., Haifa.
For primary bibliographic entry see Field 5B.
W80-02905

SIMPLIFIED DIURNAL CURVE ANALYSIS,
Hickok (Eugene A.) and Associates, Inc., Wayzata, MN.
For primary bibliographic entry see Field 5B.
W80-02913

CONTAMINATION OF THE MEDITERRANEAN BLUE AND WHITE DOLPHIN BY ORGANOCHLORINE COMPOUNDS (IN FRENCH),
Institut Scientifique et Technique des Peches Maritimes, Nantes (France).
C. Alzieu, and R. Duguy.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de la Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 331-334, 1979. 2 Tab, 3 Ref.

Descriptors: *Pesticide residues, *Marine fish, Polychlorinated Biphenyls, DDT, DDD, DDE, Chemical analysis, Pesticide kinetics, Chlorinated hydrocarbon pesticides, Toxicity, Growth Stages, *Dolphins, *Stenella, *Tissue analysis, *Bioaccumulation, *Mediterranean Sea.

The contamination levels of PCB, DDT and metabolites were analysed in tissue of 22 dolphins, Stenella coeruleoalba, stranded on the Mediterranean coast of France. The organochlorine content was higher in the blubber and liver than in the other organs. The immature animals, and particularly a new born animal were more contaminated than the adults. Certain observations suggest that the health of the dolphin may be endangered if PCB level in the liver exceeds 20 mg/kg of dry frozen tissue. (Deal-EIS)
W80-02940

THE TEMPERATURE AND OXYGEN LETHAL LIMITS OF ACARTIA CLAUSI GIESBRECHT IN A POLLUTED MARINE ECOSYSTEM,
Athens Univ. (Greece). Dept. of Zoology.
C. Yannopoulos.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de la Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 359-363, 1979. 3 Fig, 1 Tab, 6 Ref.

Descriptors: *Water temperature, *Oxygen requirements, *Copepods, Thermal stress, Water chemistry, Dissolved oxygen, Biomass, Annual, Seasonal, Salinity, Zooplankton, Statistical analysis, *Acartia.

The temperature and oxygen lethal limits, in vivo, of the copepod Acartia clausi, have been estimated in the Elefsis Bay marine ecosystem where environmental conditions seem to be extremely favourable for the growth of this species only. Temperature Upper Lethal limits may be considered to be between 20.7 to 22.1 C and Oxygen Low Lethal limits to be about 3.20 ml O2/l H2O. However, because oxygen concentrations are primarily de-

pendent on water temperature, it can be concluded that oxygen must have a synergistic effect, together with temperature, rather than a direct influence on the decline of this species during the warm period of each year. (Deal-EIS)
W80-02941

STUDIES IN REGARD TO DIFFERENT TYPES OF ACTION OF DETERGENTS ON MARINE SPECIES (IN FRENCH),
Centre d'Oceanographie, Marseille (France). Station Marine d'Endoume.
G. Bellan, R. Kaim-Malka, A. Ladjal, G. Stora, and S. Tahvildari-Damoui.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de la Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 411-415, 1979. 2 Tab, 17 Ref, (English summary).

Descriptors: *Detergents, *Surfactants, *Toxicity, *Bioassay, Laboratory Tests, Benthos, Polychaetes, Molluscs, Crustaceans, Echinoderms, Mortality, Water pollution effects, Methodology.

Action in vitro of detergents on benthic marine invertebrates has been studied during 9 years. Every stage of life cycle and every metabolitic functions may be altered by these pollutants. These studies permit also to explain better the different sensibility of species to pollutants. The results obtained in standing water tests are similar to those obtained on flowing water tests. Detergents used in bioassay tests were anionic and non-ionic. The toxicity of various commercial detergents was determined as was the effect on their development. Anatomical and cellular changes were observed. (Katz-EIS)
W80-02944

EFFECTS OF THE DEFOLIANT 2-4-5-T ON THE DINOFLAGELLATE PROROCENTRUM MICANS IN CULTURE (IN FRENCH),
Arago Lab., Banyuls-sur-Mer (France).
F. De Billy.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de la Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 431-434, 1979. 2 Fig.

Descriptors: *Toxicity, Mortality, *Phytoplankton, Water pollution effects, *Bioassay, Laboratory tests, Diatoms, Plant Pathology, Plant physiology, Herbicides, Growth, Growth inhibition, Defoliant 2-4-5-T.

A dose of 40 micro Moles/1 of 2-4-5-T causes a lethal reaction in a culture of Prorocentrum micans. The growth inhibition is inversely proportional to the concentration of 2-4-5-T. A total inhibition is attained at a dose higher than 300 micro Moles/1. Electron microscopic observation indicates changes in the intracellular organelles both in the cytoplasm and the nucleus. (Katz-EIS)
W80-02945

LETHAL AND SUBLETHAL EFFECTS OF MERCURY SALTS ON MONODONTA ARTICULATA,
Royal Univ. of Malta, Valletta. Dept. of Biology.
L. J. Saliba, V. Schembri, and M. G. Vella.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de la Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 319-323, 1979. 1 Fig, 2 Tab, 5 Ref.

Descriptors: *Mercury, *Toxicity, *Mollusks, Chlorides, Sulfates, Oxygen requirements, Animal physiology, Animal behavior, Salts, Chemical properties, Bioassay, *Mercury compounds, *Acetates.

The comparative toxicity of mercuric acetate, chloride and sulphate to Monodonta articulata Lamarck is described. Effects of sublethal concentrations of the three salts on immersion/emersion behaviour, interface activity, and aquatic oxygen consumption are investigated. Emersion periods generally increase, and immersion and activity periods decrease with rises in mercury concentration. All three salts reduce aquatic oxygen consumption at levels of 0.01 ppm Hg ++, consumption decreasing further with rises in concentration. Mercuris sulphate exhibits the greatest overall effect. (Deal-EIS)
W80-02946

NOXIOUS EFFECTS OF DIESEL OIL D-2 AND THE SYNERGISTIC EFFECT OF POLYCHLORINATED BIPHENYLS (AROCLOR 1242) ON ZOOPLANKTON SPECIES EURYDICE TRUNCATA,
Biological Inst., Dubrovnik (Yugoslavia).
F. Krsinic, D. Vilicic, M. Picer, and N. Picer.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de la Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 307-312, 1979. 2 Fig, 4 Ref.

Descriptors: *Oil, *Polychlorinated biphenyls, *Toxicity, *Isopods, Zooplankton, Bioassay, Mortality, Aroclors, Fuels, Gas chromatography, Animal physiology, Animal behavior, Phytoplankton, *Eurydice.

Preliminary research has been performed on the influence of Diesel oil D-2 and the synergistic effect of Aroclor 1242 on the isopod Eurydice truncata. The organisms were maintained in glass cylinders at constant temperature and light-dark cycle. They were fed a mixture of phytoplankton cultures (Skeletonema costatum and Cryptomonas sp.). Polluting substances were added to the system in the form of emulsion after being shaken for 30 minutes in natural sea water. Diesel oil D-2 was added in the following concentrations: 0.01 ppm, 0.1 ppm, 015 ppm, 1 ppm, 5 ppm and 10 ppm. Aroclor 1242 was always in a concentration of 0.2 ppb. The control of polluting substance concentration in the system was performed by means of the E. C. gas chromatography and spectrofluorometry. At a concentration of 10 ppm Diesel oil in the course of 48 hours the mortality was rather high in all tested organisms, while at concentrations less than 1 ppm no mortality effects were registered even after the addition of Aroclor 1242. (Deal-EIS)
W80-02947

NEW DATA ON THE DISTRIBUTION OF POLLUTANTS AND THEIR EFFECT ON SOME HYPONEUSTON CONSTITUENTS IN THE S.E. MEDITERRANEAN,
Alexandria Inst. of Oceanography and Fisheries (Egypt).
M. L. El-Hehyawi.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de la Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 301-305, 1979. 2 Fig, 4 Tab, 4 Ref.

Descriptors: *Oil pollution, *Heavy metals, *Zooplankton, Oil, Oil Spills, Organic compounds, Seasonal, Coasts, Spectrophotometry, Beaches, *Zinc, *Cadmium, *Mercury, *Lead, Fish eggs, Chemical analysis, *Tar balls, *Hyponeuston, *Mediterranean Sea, *Egypt.

Pollution in the shallow waters of the S.E. Mediterranean was found to have a detectable influence in some restricted localities. But in the open sea waters it had little effect upon the hyponeustonic organisms. The main problem coming from oil pollution is the accumulation of the hydrocarbons and tar balls on some beaches under the influence of the north-westerly winds. In addition, the very poor zooplankton abuandance in the oil drilling area in Abu-Qir Bay may reveal that measures for protection against effective hydrocarbons are inadequate. The mercury content of the meroplankton organisms and the species Euterpina, was detected in relatively high concentration levels in the Eastern Harbour. The zooplankton abundance and the fish eggs in the hyponeuston layer varied within a wide range (2.0-500.0 counts/sqm) according to the environmental conditions. It was difficult to differentiate between the effect of the pollutants and other factors except in south-western part of Abu-Qir Bay. (Deal-EIS)
W80-02948

BIOACCUMULATION FROM WATER AND ELIMINATION OF VANADIUM IN SELECTED MARINE INVERTEBRATES,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
P. Miramand, J. C. Guary, and S. W. Fowler.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique se la Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 277-279, 1979. 4 Ref.

Descriptors: *Path of pollutants, *Invertebrates, *Metals, Absorption, Sorption, Radiochemical analysis, Tracers, Water temperature, Salinity, Worms, Mussels, Shrimp, Crabs, Animal metabolism, Geochemistry, *Vanadium, *Depuration, *Bioaccumulation.

Radiotracer experiments using 48V were designed to follow the bioaccumulation from sea water and elimination of vanadium in four invertebrates common to the Mediterranean. Uptake appeared to be essentially a physical sorption phenomenon which was little affected by temperature. Loss, on the other hand, was enhanced at elevated temperatures. Vanadium accumulation was inversely proportional to salinity over a range from 38% to 19%. Radioisotope loss from shrimp was unaffected by salinity; in the case of mussels, there was a slight tendency for increased loss at low salinities. Patterns of loss as well as biological half-times varied with species. Molting was found to be particularly effective in removing incorporated vanadium from crustaceans. The casting of molts is considered to be an important link in the marine biogeochemical cycle of vanadium. (Deal-EIS)
W80-02952

COMPARISON BETWEEN THE HG BODY BURDEN OF THYNNUS THYNNUS FROM THE MEDITERRANEAN AND THE ATLANTIC,
Siena Univ. (Italy). Lab. di Idrobiologio.
A. Renzoni, M. Bernhard, R. Sara, and M. Stoeppler.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de la Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 255-260, 1979. 4 Fig, 1 Tab, 13 Ref.

Descriptors: *Mercury, *Fish physiology, *Absorption, Heavy metals, Size, Chemical analysis, Length, Atlantic Ocean, Water pollution sources, Path of pollutants, Fish migrations, Spawning, *Tuna, *Tissue analysis, *Bioaccumulation, *Mediterranean Sea.

Mercury body burden was determined in tuna specimens of different sizes from the Italian coast and the Strait of Gibraltar. Specimens from about 20 cm length to 250 cm showed a strong and significant increase of Hg concentration with length. Tunas greater than 250 cm had much lower (1/4) body burdens. Their Hg/length correlations is weak. The differences in the Hg body burden are explained by assuming that the tunas with higher body burdens are from the Mediterranean and the ones with lower body burdens from the Atlantic. The latter migrate into the Mediterranean only for spawning. The higher Hg body burden in the Mediterranean tuna is due to the higher than average natural environmental level in the Mediterranean. This higher environmental level has its origin in the geochemical Hg anomaly of the Mediterranean basin. Similar results were obtained in other pelagic fishes. (Deal-EIS)
W80-02954

FLUORIDE IN ANTARCTIC KRILL (EUPHAUSIA SUPERBA) AND ATLANTIC KRILL (MEGANYCTIPHANES NORVEGICA),
Havforskningsinstitutt, Bergen (Norway). Inst. of Vitamin Research.

T. Soevik, and O. R. Braekkan.
Journal of the Fisheries Research Board of Canada, Vol 36, p 1414-1416, 1979. 2 Tab, 9 Ref.

Descriptors: *Fluorides, *Path of pollutants, Animal metabolism, Animal physiology, Crustaceans, Chemical properties, Commercial shellfish, Public health, Chemical analysis, *Krill, *Prawns, *Red feed, *Tissue analysis, *Bioaccumulation, *Bioavailability.

Samples of Antarctic krill (Euphausia superba) and Atlantic krill (Meganyctiphanes norvegica) were analyzed for fluoride using a selective fluoride electrode method. Both species showed very high concentrations, a total of 1330-2400 mg F/kg, on fat free dry weight basis in raw samples whereas deep sea prawns (Pandalus borealis) showed a total of 18-91 and red feed (Calanus finmarchicus) 10-37 mg F/kg. Sections of Antarctic krill were analyzed, and the highest concentration was found in the carapace, 4260 mg F/kg fat free dry matter, compared with 570 and 750 mg F/kg in raw and boiled muscle. Biological availability was measured in a chick assay, and showed fluoride in krill to be equally utilized as sodium fluoride added to the diet. (Deal-EIS)
W80-02957

TEMPERATURE INFLUENCE ON BASAL ACTIVITY AND INDUCTION OF MIXED FUNCTION OXYGENASE ACTIVITY IN FUNDULUS HETEROCLITUS,
Woods Hole Oceanographic Institution, MA. Dept. of Biology.
J. J. Stegeman.
Journal of the Fisheries Research Board of Canada, Vol 36, p 1400-1405, 1979. 2 Tab, 30 Ref.

Descriptors: *Killifishes, *Enzymes, *Animal metabolism, *Water temperature, Biochemistry, Fish physiology, Bioassay, Inhibition, Mode of action, Toxicity, Proteins, *Benzo(a)pyrene, Carcinogens.

Treatment of Fundulus heteroclitus acclimated to 6.5C with benzo(a)pyrene did not elicit any change in the levels of hepatic microsomal NADH- or NADPH-cytochrome c reductase activity, nor in the levels of cytochrome P-450 or its catalytic activities. However, the same treatment of fish at 16.5C resulted in a marked induction of benzo(a)pyrene hydroxylase and NADPH-cytochrome c reductase. Cytochrome P-450 content was also higher in the warm, treated fish and the Soret maximum of reduced, CO-treated microsomes was shifted to the violet. Levels of aminopyrine demethylase and NADH-cytochrome c reductase activities did not show a significant treatment effect. At neither temperature could treated and control fish be distinguished on the basis of in vitro inhibition of benzo(a)pyrene hydroxylase activity by 7,8-benzoflavone. Levels of NADPH-cytochrome c reductase and benzo(a)pyrene hydroxylase activities were greater in control Fundulus acclimated to 6.5C than to 16.5C, when normalized to microsomal protein, but not when based on body weight. The results indicate that habitat temperature alone may not affect the capacity for initial hydrocarbon metabolism in fish, but that it can strongly influence the induction of cytochrome P-450. (Deal-EIS)
W80-02958

FISH AND DAPHNIA TOXICITY AS SURROGATES FOR AQUATIC VASCULAR PLANTS AND ALGAE,
Dow Chemical Co., Midland, MI. Health and Environmental Sciences.
E. E. Kenaga, and R. J. Moolenaar.
Environmental Science and Technology, Vol 13, p 1479-1480, 1979. 2 Tab, 4 Ref.

Descriptors: *Toxicity, *Chemical wastes, *Bioindicators, Methodology, Chlorella, Daphnia, Aquatic plants, Aquatic algae, Minnows, Carp, Shiners, Chemical properties, Organic compounds, Industrial wastes, Bioassay, Mortality, Water quality standards.

The relative degree of acute toxicity of thousands of chemicals of heterogeneous structures was compared for fishes, daphnids, aquatic vascular plants, and algae. Aquatic animals were more sensitive indicators of toxic effects than were plants or algae. Compounds that were toxic at under 1 ppm for daphnids, fishes, aquatic vascular plants, and algae represented 2.4, 1.3, 0.12, and 0.02%, respectively, of the total tested for each of these four groups of organisms. Of the 27,781 chemicals tested on aquatic plants and 49,082 tested on the alga Chlorella, all but 3 compounds were either not toxic to these organisms under 1 mg/l, or were toxic to fish and Daphnia at 1 ppm or less. (Deal-EIS)
W80-02960

EXAMINATION OF PHOSPHORUS CYCLING AND CONTROL OF PHYTOPLANKTON DYNAMICS IN LAKE ONTARIO WITH AN ECOLOGICAL MODEL,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
D. Scavia.
Journal of the Fisheries Research Board of Canada, Vol 36, p 1336-1346, 1979. 8 Fig, 2 Tab, 66 Ref.

Descriptors: *Lake Ontario, *Mathematical models, *Phytoplankton, *Phosphorus, Nutrients, Seasonal, Biomass, Zooplankton, Calcium carbonate, Epilimnion, Chemical properties, Food webs, Diatoms, Crustaceans, Copepods, Great Lakes.

An ecological model of Lake Ontario was used to assist in interpretation of data collected during the International Field Year for the Great Lakes (March 1972-April 1973). The analysis indicated that in spring and fall phytoplankton biomass is controlled by the interaction of incoming solar radiation and vertical mixing, in summer by silica- and phosphorus-limitation, and in late summer by zooplankton grazing. The influence of CaCO3 precipitation on the light climate in late summer was also demonstrated. During the period of stratification, available phosphorus concentration is controlled by recycling within the epilimnion, primarily through plant and animal excretion. Comparison of simulated available phosphorus concentrations and concentrations of total dissolved phosphorus and soluble reactive phosphorus in the epilimnion suggest that the composition of the soluble unreactive phosphorus pool changes dramatically during the year and that the large pool of dissolved unavailable phosphorus during summer is composed of end products of material cycled several times through the food web. (Deal-EIS)
W80-02962

HEAVY METALS IN THE NATIVE OYSTER (OSTREA ANGASI) AND MUSSEL (MYTILUS EDULIS PLANULATUS) FROM PORT DAVEY, SOUTH-WESTERN TASMANIA,
Tasmanian Fisheries Development Authority, Taroona.
J. D. Thomson.
Australian Journal of Marine and Freshwater Research, Vol 30, p 421-424, 1979. 1 Tab, 13 Ref.

Descriptors: *Heavy metals, *Oysters, *Mussels, Zinc, Cadmium, Copper, Lead, Chemical analysis, Water quality standards, Public health, Spectrophotometry, Water pollution sources, *Australia, *Tissue analysis, *Bioaccumulation.

Oysters and mussels were sampled from Port Davey in winter 1975 and summer and winter 1978. The permissible concentration for zinc provisionally recommended by the National Health and Medical Research Council was exceeded in oysters, and the standard for lead was exceeded in both mussels and oysters in the 1975 sample. Port Davey is isolated and virtually uninhabited and the metals derive from natural sources. (Deal-EIS)
W80-02963

ENTRAINMENT AND IMPINGEMENT OF FISH BY POWER PLANTS IN THE GREAT LAKES WHICH USE THE ONCE-THROUGH COOLING PROCESS,
Fisheries and Marine Service, Sault Ste. Marie (Ontario). Great Lakes Biolimnology Lab.
J. R. M. Kelso, and G. S. Milburn.
Journal of Great Lakes Research, Vol 5, No 2, p 182-194, 1979. 9 Fig, 5 Tab, 20 Ref.

Descriptors: *Fish populations, *Mortality, *Entrainment, Powerplants, Cooling waters, Intakes, Great Lakes, Commercial fish, Toxicity, Bass, Carp, Perches, Seasonal, *Impingment, *Clupeids.

There are 89 thermal electric generating stations, producing 54,118 Megawatts (Mwe) of electricity, which use water directly from the Great Lakes. These power plants require almost 2000 m3s-1 of cooling water or, conservatively, 30% of the flow of the St. Lawrence River. Impingement of fish is directly related to power plant size and we calculated that more than 100,000,000 fish will be lost at existing and proposed stations. Impingement results in direct losses to the fishery of more than 25%, by weight, of the annual commercial fish harvest. Entrainment is also directly related to power plant size and we expect more than 1.28 time 10 to the 9th power larval fish will be lost by entrainment. These estimates of entrainment and impingement are conservative since they are based upon rated pumping capacity, not actual usage which was 67% for the few plants that provided this information. Impingement losses, when combined with entrainment losses which will affect recruitment to some unknown degree, likely constitute a significant undersirable impact upon the Great Lakes fishery. (Deal-EIS)
W80-02965

FLUXES OF DISSOLVED AND PARTICULATE CALCIUM IN SELECTED TISSUES OF CRASSOSTREA VIRGINICA,
Delaware Univ., Lewis. Marine Studies Complex.
For primary bibliographic entry see Field 5B.
W80-02966

EFFECTS OF TEMPERATURE ON THE GROWTH AND SURVIVAL OF THE EUROPEAN EEL, ANGUILLA ANGUILLA L.,
Central Electricity Generating Board, Ratcliffe-on-Soar (England). Freshwater Biology Unit.
K. Sadler.
Journal of Fish Biology, Vol 15, p 499-507, 1979. 4 Fig, 1 Tab, 16 Ref.

Descriptors: *Eels, *Water temperature, *Growth rates, Heated water, Cooling waters, Thermal pollution, Powerplants, Aquiculture, Toxicity, Animal behavior, Mortality, Fish physiology, Animal metabolism.

Experiments to determine the growth rate of eels at different temperatures are described and show the optimum temperature for growth to be 22-23C. The ultimate upper lethal temperature was found to be 38C and the critical thermal maximum varied from 33 to 39C for fish acclimated at 14 to 29C. An attempt was also made to determine lower lethal temperatures. Eels enter a state of torpor at temperatures varying from 3C for fish acclimated at 29C to less than 1C for fish acclimated at 23C or below. The results have been used to estimate the growth rates expected from eels cultured in power station cooling water using different types of temperature control. (Deal-EIS)
W80-02968

MERCURY CONTENT OF SHARK FROM SOUTH-WESTERN AUSTRALIAN WATERS,
Western Australia Dept. of Fisheries and Fauna, Perth. Marine Research Labs.
N. Caputi, J. S. Edmonds, and D. I. Heald.
Marine Pollution Bulletin, Vol 10, p 337-340, 1979. 2 Fig, 2 Tab, 8 Ref.

Descriptors: *Mercury, *Sharks, *Commercial fish, Path of pollutants, Heavy metals, Chemical analysis, Spectrophotometry, Size, Length, Trophic level, Regression analysis, *Tissue analysis, *Bioaccumulation, *Australia.

Muscle samples from four species of commercially sought shark (Thickskin, Carpet, Hammerhead and Grey Nurse) have been analyzed for total mercury.

The standard flameless atomic absorption spectrophotometric techniques were used. As with other predatory and longlived species of fish, such as tuna and black marlin, these four species of shark accumulate substantial quantities of mercury. Mercury concentration was found to be related to the length of the fish. Mean mercury levels for large individuals of all species was over 1.0 ppm. (Deal-EIS)
W80-02972

MAJOR DETOXIFICATION PATHWAYS FOR PENTACHLOROPHENOL IN GOLDFISH,
Kyushu Univ., Fukuoka (Japan). Lab. of Fisheries and Chemistry.
K. Kobayashi, and N. Nakamura.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 45, No 9, p 1185-1188, 1979. 3 Fig, 3 Tab, 7 Ref.

Descriptors: *Animal metabolism, *Organic compounds, *Path of pollutants, Fish physiology, Chemical properties, Chemical reactions, Biochemistry, Sulfates, Absorption, Biodegradation, *Pentachlorophenol(PCP), *Goldfish, *Tissue analysis, *Bioaccumulation, Detoxification.

A study was made to demonstrate the contribution of the branchial, renal, and biliary routes to the PCP excretion in goldfish, Carassius auratus, and also to determine the importance of the sulfate and glucuronide conjugations as the detoxification mechanisms for PCP in the fish. The amounts of PCP excreted from the branchial, renal, and biliary routes corresponded to approximately 52, 24, and 22% of the total amount of PCP (approx. 5 micromol) excreted by the fish (av. 68g) for 24h after 24-h exposure to 0.1 ppm PCP. The excretion of PCP from the body surface was negligibly small compared with that from the above three routes. Approximately 30% of the PCP excreted from the gills was in a free-form, whereas almost all the PCP excreted in both of the bile and urine was in a conjugated-form. The total amount of the sulfate conjugate excreted in the surrounding water and the urine was ca. 3 micromol, while that of the glucuronide in the bile was ca. 1 micromol. However, a considerable amount of the PCP-glucuronide in the bile was hydrolyzed by the intestinal mucus of fish. This indicates that the glucuronide conjugation is not so important as compared with the sulfate conjugation to eliminate PCP from the fish body, because the PCP released from the glucuronide in the intestine must be reabsorbed there. (Deal-EIS)
W80-02973

A CULTURE STUDY OF SALINITY RESPONSES IN ECOTYPES OF TWO ESTUARINE RED ALGAE,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Botany.
C. Yarish, P. Edwards, and S. Casey.
Journal of Phycology, Vol 15, p 341-346, 1979. 5 Fig, 4 Tab, 14 Ref.

Descriptors: *Salinity, *Habitats, *Rhodophyta, Bioassay, Laboratory test, Growth rates, Adaptation, Cycles, Algae, Estuaries, Growth stages, Salt tolerance, Metabolism.

Laboratory culture studies on the euryhalinity of Bostrychia radicans and Caloglossa leprieurii from the mouth and head of the Mullica River estuary, New Jersey, revealed both species probably have ecotypes whose growth patterans correlate with the salinity regime of their habitat in nature. Significant growth differences of tetrasporelings were determined in response to four salinities (5, 15, 25, 35%) even after acclimation periods of the tetrasporophytes from 6 mo-2 yr in laboratory culture. However, one isolate of Bostrychia and both isolates of Caloglossa also demonstrated some capability for physiological adaptation to salinity changes although this was less significant statistically than their ecotypic response. It thus appears that certain euryhaline algae may consist of ecotypes, each of which has some capacity for physiological adaptation to salinity variations. (Deal-EIS)
W80-02974

EFFECTS OF ARSENIC SPECIATION AND PHOSPHATE CONCENTRATION ON ARSENIC INHIBITION OF SKELETONEMA COSTATUM (BACILLARIOPHYCEAE),
Skidaway Inst. of Oceanography, Savannah, GA.
J. G. Sanders.
Journal of Phycology, Vol 15, p 424-428, 1979. 3 Fig, 26 Ref.

Descriptors: *Arsenic compounds, *Inhibition, *Productivity, *Diatoms, Absorption, Metabolism, Algae, Growth rates, Phosphorus, Phosphates, Nutrient requirements, Chemical properties, *Arsenic, *Arsenate, *Skeletonema.

Arsenate is taken up readily by Skeletonema costatum due to its chemical similarity to phosphate, and it inhibits primary productivity at concentrations as low as 67 nannoM when the phosphate concentration is low. A phosphate enrichment of greater than 0.3 microM alleviates this inhibition; however, the arsenate stress causes an increase in the cell's requirement for phosphorus. Arsenate is also toxic to Skeletonema at similar concentrations. Methylated species, such as dimethylarsinic acid, did not affect cell productivity at the levels examined. Thus, the reduction and methylation of arsenate to dimethylarsinic acid by the cell produces a stable, non-toxic compound. (Deal-EIS)
W80-02975

VITAMIN B12-BINDER AND OTHER ALGAL INHIBITORS,
Yale Univ., New Haven, CT. Dept. of Biology.
I. J. Pintner, and V. L. Altmeyer.
Journal of Phycology, Vol 15, p 391-398, 1979. 8 Fig, 3 Tab, 14 Ref.

Descriptors: *Vitamins, *Metabolism, *Algae, *Inhibitors, Diatoms, Dinoflagellates, Cyanophyta, Chlorophyta, Chrysophyta, Chemical properties, Inhibition, Biochemistry, Proteins, Growth rates, Marine algae, Aquatic algae, *Vitamin B12.

Euglena gracilis, Poteriochromonas malhamensis, Monochrysis lutheri, Isochrysis galbana and Phaeodactylum tricornutum are known to release into the medium a substance which binds free vitamin B12. Culture filtrates of selected marine diatoms, chrysophytes, cryptophytes, dinoflagellates and green algae contained the binder, indicating that binder release was not restricted to any algal group. Production increases with density of the culture and is not restricted to stationary or scenescent cells. The marine species tested produced much less B12 than the freshwater Euglena and Poteriochromonas; the inhibition is reversed by 20-50 ng/l of B12 for marine species which reach moderate densities and by 150-300 ng/l B12 for the densely growing species. Consequently the binder may affect the growth of B12-requiring species only in environments like the open ocean poor in B12. By contrast, the marine algae produce other inhibitors which are often heat stable and very inhibitory. (Deal-EIS)
W80-02977

EFFECTS OF THREE OIL SPILL DISPERSANTS ON MARINE BACTERIAL POPULATIONS. I. PRELIMINARY STUDY. QUANTITATIVE EVOLUTION OF AEROBES,
Aix-Marseille-I Univ. (France). Lab. de Microbiologie du Milieu Marin.
D. Marty, A. Bianchi, and C. Gatellier.
Marine Pollution Bulletin, Vol 10, p 285-287, 1979. 3 Tab, 7 Ref.

Descriptors: *Oil spills, *Marine bacteria, Oil, Oil pollution, Organic compounds, Bacteria, Growth rates, Aerobic bacteria, Aquatic populations, Water pollution treatment, Oil-water interfaces, *Dispersants, *Corexit, *Crude oil.

The effects of three hydrocarbon dispersant agents (Corexit 9527, Hydrogamosol LT and OSR LT 126) on the bacterial flora of the marine environment are analysed in 20-square-metre basins filled with lagoon seawater. Four months after the first treatment, oil slicks were no longer visible, whereas the appearance of the untreated reference slick had hardly changed. The treatment of 10-litre crude-oil slicks causes an appreciable and long lasting increase in the bacterial population. (Deal-EIS)
W80-02978

TOXICITY OF SOLUBLE COPPER AND OTHER METAL IONS TO ELODEA CANADENIS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
B. T. Brown, and B. M. Rattigan.
Environmental Pollution, Vol 13, p 303-314, 1979. 6 Fig, 3 Tab, 31 Ref.

Descriptors: *Toxicity, *Copper, *Aquatic plants, Methodology, Analytical techniques, Metals, Ions, Inhibition, Phytosynthesis, Herbicides, Mode of Action, Bioassay. *Elodea.

A procedure for observing the effects of dissolved copper and other metal ions on the submersed aquatic macrophyte Elodea canadensis has been described. Metal concentrations have been determined which inhibit light-induced oxygen evolution from plant segments after short-term exposure (24th), and which produce phytotoxicity in whole plants over a longer period (28 days). These results are discussed in terms of the phytotoxic effects on Elodea resulting from dissolved metal ions present in polluting concentrations in natural water bodies or from the use of added copper as an aquatic herbicide. (Deal-EIS)
W80-02980

DISTRIBUTION OF ESSENTIAL AND TOXIC METALS IN THE TERRESTRIAL GASTROPOD ARION ATER,
University Coll. of Wales, Aberystwyth. Dept. of Zoology.
M. P. Ireland.
Environmental Pollution, Vol 13, p 271-278, 1979. 4 Tab, 32 Ref.

Descriptors: *Trace elements, *Metals, *Gastropods, Magnesium, Lead, Zinc, Manganese, Calcium, Phosphates, Cadmium, Copper, Path of pollutants, Soil chemistry, Absorption, Animal metabolism, *Arion, *Tissue analysis.

A study was made of the metal concentrations in the gastropod Arion ater at two sites. In whole animals, all metals analysed, except magnesium, were higher in concentration at the Cwmystwyth site where high amounts of lead, zinc and manganese but low concentrations of calcium and phosphate were found in vegetation. Individual tissues analyses showed high concentrations of magnesium, zinc, cadmium and phosphate in digestive gland and high concentrations of calcium in digestive gland and mantle. Lead and copper did not concentrate to any extent in a specific tissue. Manganese was located mainly in mantle, skin and foot. Mucus secreted from Cwmystwyth slugs contained high amounts of zinc and manganese, and granules isolated from the digestive gland, more zinc. Both extracts contained less calcium and magnesium than extracts from campus slugs. The results are discussed in relation to metal concentrations in vegetation and soil together with excretion and uptake mechanisms. (Deal-EIS)
W80-02981

EFFECTS OF SALINITY ON THE RESPIRATION AND HEART RATE OF THE COMMON MUSSEL, MYTILUS EDULIS L., AND THE BLACK CHITON, KATHERINA TUNICATA (WOOD),
Louisiana State Univ., Baton Rouge.
W. B. Stickle, and T. D. Sabourin.
Journal of Experimental Marine Biology and Ecology, Vol 41, p 257-268, 1979. 2 Fig, 3 Tab, 31 Ref.

Descriptors: *Salinity, *Toxicity, *Respiration, *Mussels, Animal physiology, Wanimal metabolism, Oxygen requirements, Mollusks, Salt tolerance, Cycles, Adaptation, Fluctuations, Mytilus, *Chiton, *Heart rate.

The rate of oxygen consumption of stepwise acclimated mussels increased linearly from 30 10 o/oo

salinity (S) while that of Katherina tunicata was not significantly different between 10 and 30 o/oo S. Heart rate was 21-22 and 17-18 beats/m2 in M. edulis and K. tunicata, respectively, and no difference was found in the heart rate of either species acclimatedstepwise to 10, 20 or 30 o/oo S. The average oxygen consumption rate of M. edulis exposed to 12 h, 30-10 - 30 and 10-30-10 o/oo S cycles of fluctuating salinity was significantly lower than the respective control rate: there was a similar response during the 30-10-30 o/oo S cycle in K, tunicata. The respiration rate of M. edulis and K. tunicata declined as salinity deviated from the control salinity and increased as salinity returned to the control salinity. The rate of oxygen consumption by K. tunicata varied directly with the ambient salinity during the 10-30-10 o/oo S cycle. The average heart rate of M. edulis was significantly lower during cyclic changes in salinity than at the respective control salinities; a similAr relationship existed for K. tunicata during the 10-30-10 o/oo S cycle. Heart rate of M. edulis varied in a parallel manner with oxygen consumption during both cycles. K. tunicata heart rate was relatively constant and could not be fitted to a regression line during the 10-30-10 o/oo S cycle. The normalized heart rate increased to 113% of control at 10 o/oo S of the 30-10-30 o/oo S cycle and returned to the control rate by 12 h. (Deal-EIS)
W80-02983

DISTRIBUTION OF COBALT 60 IN A MOLLUSC, A CRUSTACEAN AND A FRESHWATER TELEOST: VARIATIONS AS A FUNCTION OF THE SOURCE OF POLLUTION AND DURING ELIMINATION,
CEA Centre d'Etudes Nucleaires de de Cadarache, Saint-Paul-les Durance (France). Dept. de Protection.
J. C. Amiard, and C. Amiard-Triquet.
Environmental Pollution, Vol 13, p 199-213, 1979. 4 Fig, 4 Tab, 25 Ref.

Descriptors: *Cobalt radioisotopes, *Path of pollutants, *Absorption, Animal physiology, Fish physiology, Animal metabolism, Mollusks, Snails, Crustaceans, Crayfish, Carp, Radiochemical analysis, *Bioaccumulation, *Tissue analysis.

Radioisotopes of cobalt (57,58,60Co) are present in nuclear test debris as well as in effluents of the non-military nuclear industry. The stable isotope, which is a constituent of vitamin B12, has very important biological functions. For each species, three experiments were carried out: (1) starved animals were immersed in 60Co-contaminated water; (2) animals were immersed in contaminated water and received radioactive food and (3) animals were placed in fresh water without any pollutant but received contaminated food. Radiation doses were calculated for contamination via both food and water. When 60Co is taken up directly from water, the most contaminated organs are external ones, especially the shell of the snail Lymnaea palustris and the exoskeleton and feeding appendages of the crayfish Astacus leptodactylus. Contamination via food is responsible for a relatively greater accumulation of radiocobalt in internal organs. The cobalt content of muscles-that is to say the edible parts of crayfish and common carp is very low. The highest concentrations recorded are in the visceral mass of the snail, the digestive gland of the crayfish and the kidneys of the carp. Internal doses for these organs are considerably higher than those for entire animals. Therefore, as a result of 60Co distribution, they are critical organs for the freshwater species. Except for the carp, external radiation is very weak compared with internal radiation. (Deal-EIS)
W80-02984

OXYGEN CONSUMPTION AND THE RESPIRATORY RESPONSES TO DECLINING OXYGEN TENSION IN THE CRAB EBALIA TUBEROSA (PENNANT) (CRUSTACEA: DECAPODA: LEUCOSIIDAE),
Marine Biological Station, Millport (Scotland).
P. J. Schembri.
Journal of Experimental Marine Biology and Ecology, Vol 41, p 133-142, 1979. 5 Fig, 1 Tab, 20 Ref.

Descriptors: *Crabs, *Oxygen requirements, *Animal behavior, Dissolved oxygen, Water chemistry, Size, Weight, Animal metabolism, Respiration, Animal physiology, Crustaceans.

Oxygen consumption and its relationship to body weight and activity have been examined in Ebalia tuberosa (Pennant). Ebalia showed only very limited ability to regulate their oxygen consumption under conditions of declining P02. Respiratory independence was markedly affected by the level of activity of the animals. When inactive, respiratory independence was maintained down to a critical P02 of only about 130 mm Hg while when active, the crabs behaved as perfect conformers. Inactive Ebalia responded to a decrease in P02 by increasing the pumping activity of the scaphognathites and heart. This increased activity continued even at oxygen tensions lower than the Pc. The rate of reversals of the ventilatory currents did not change with decreasing P02. In the active crabs, the pumping activity of the scaphognathites and heart, and the rate of current reversals were higher than in the inactive animals, and a decrease in P02 did not bring about any further change in any of these responses. When exposed to hypoxic conditions for long periods initially inactive crabs survived longer than did active animals. (Deal-EIS)
W80-02986

MECHANISMS OF DDT RESISTANCE IN LARVAE OF THE MOSQUITO AEDES AEGYPTI L.,
Victoria Univ. of Manchester (England). Dept. of Zoology.
A. E. McDonald, and R. J. Wood.
Pesticide Science, Vol 10, p 375-382, 1979. 5 Tab, 24 Ref.

Descriptors: *DDT, *Mosquitoes, *Pesticide toxicity, *Resistance, Biodegradation, DDE, Pesticide kinetics, Genetics, Adaptation, Animal metabolism, Larval growth stage, Insects, Insecticides, Chlorinated hydrocarbon pesticides, Mortality, *Chlorfenethol, *Sesamex.

Larvae of eight strains of Aedes aegypti were exposed to DDT and compared for resistance, DDT uptake, in-vivo breakdown of DDT and residual unmetabolised DDT. Resistance varied widely between strains, three being fully susceptible, two almost immune and three of intermediate resistance. Breakdown of DDT by dehydrochlorination to 1,1-dichloro-2,2-bis(4-chlorophenyl)ethylene(pp'-DDE) occurred in all strains and was greater in the five resistant types, but there was no significant correlation between the extent of breakdown in the resistant strains and the level of resistance. Moreover the overall difference between susceptible and resistant strains disappeared when they were compared at a low, almost sublethal, concentration of DDT. Larvae of resistant strains carried a greater absolute quantity of unmetabolised DDT in the body and were able to tolerate levels of DDT that were lethal to susceptible larvae. However the two most resistant strains contained significantly less DDT plus pp'-DDE than strains of intermediate resistance from which they had been derived. It is concluded that three factors contribute to larval DDT resistance in A. aegypti; (1) increased metabolism to pp'-DDE; (2) increased tolerance to unmetabolised internal DDT; and (3) reduced content of DDT+pp'-DDE (only in the most resistant strains and due either to reduced absorption or increased excretion). These factors are discussed in relation to known larval resistance genes. (Deal-EIS)
W80-02987

THE GILL SIALIC ACID CONTENT AS AN INDEX OF ENVIRONMENTAL STRESS IN RAINBOW TROUT, SALMO GAIRDNERI, RICHARDSON,
Genova Univ. (Italy). Inst. of Zoology.
A. Arillo, C. Margiocco, and F. Melodia.
Journal of Fish Biology, Vol 15, p 405-410, 1979. 1 Fig, 1 Tab, 18 Ref.

Descriptors: *Bioindicators, *Rainbow trout, *Ammonia, Hydrogen ion concentraton, Water chemistry, Water quality, Fish physiology, Monitoring, Analytical techniques, Biochemistry, Acids, *Tissue analysis, *Gills.

The gill sialic acid content in rainbow trout exposed to several aqueous concentrations of ammonia and/or to a high environmental pH was determined by two different methods. The results showed Warren's method was adequate for the biological material, even without purification of the extracts by Dowex 2x8 resin. A significant increase of the sialic acid concentration occurred in fish exposed to ammonia.
W80-02988

PHYTOPLANKTON RESPONSE TO LOW LEVEL NUTRIENT ENRICHMENT THROUGH UPWELLING IN THE COLUMBIAN CARIBBEAN BASIN),
Rosenstiel School of Marine and Atmospheric Science, Miami, FL.
J. E. Corredor.
Deep-Sea Research, Vol 26A, p731-741, 1979. 6 Fig, 2 Tab, 26 Ref.

Descriptors: *Phytoplankton, *Growth rates, *Nutrients, *Upwelling, Water circulation, Nitrates, Biomass, Productivity, Water chemistry, Ecosystems, Stratification, *Carribean Sea.

Inorganic nutrient enrichment through upwelling in the eastern Colombian Caribbean Basin stimulates phytoplankton growth. Growth rates, however, are significantly lower than those observed in the upwelling ecosystems in the major eastern boundary currents because of the relatively impoverished nature of the source waters for the Guajira upwelling: the Subtropical Underwater. Initial organic growth factor limitation appears to cause uncoupling of nitrate uptake and phytoplankton biomass increase. Nitrate levels in recently upwelled waters are rapidly reduced to concentrations close to half-saturation constants previously reported for marine phytoplankton. (Deals-EIS)
W80-02989

EFFECTS OF TEMPERATURE AND FOOD ON DEVELOPMENTAL TIMES AND GROWTH IN DAPHNIA OBTUSA KURZ AND SIMOCEPHALUS VETULUS (O. F. MULLER) (CRUSTACEA, CLADOCERA),
Istituto Italiano di Idrobiologia, Pallanza.
R. DeBernardi, P. Lacqua, and E. Soldavini.
Memorie dell'Istituto Italiano di Idrobiologia, Vol 36, p 171-191, 1978. 5 Fig, 6 Tab, 38 Ref.

Descriptors: *Water temperature, *Growth rates, *Feeding rates, Daphina, Crustaceans, Zooplankton, Growth stages, Productivity, Regression analysis, Statistical analysis, Adaptation, Fertility, Fecundity, *Simocephalus.

A set of experiments has been constructed in order to investigate the influence of temperature and food availability on the developmental rates and growth of the two cladocerans Daphnia obtusa and Simocephalus vetulus. Four temperatures (20, 15,10,5C) and six food levels (60, 20, 5, 2, 1, 0.5 cal/1) have been tested. No direct relationships were found between the food level and time of egg development. However, the food availability affected the number and size of eggs in the brood pouch. A significant regression between temperature in degrees centigrade and post-embryonic development time in hours was found for both species. The data was discussed as it pertained to strategies of food resources utilization. (Deal-EIS)
W80-02990

THE OCCURRENCE AND SEASONAL VARIATIONS OF NA, K, CA, MG AND HEAVY METALS IN TAIWAN'S OYSTERS AND CLAMS,
Taiwan Provincial Coll. of Marine Science and Technology, Keelung.
S.-Y. Hsu, G.-S. Wang, and S.-S. Jeng.
Bulletin of the Institute of Zoology, Academia Sinica, Vol 18, No 1, p 11-20, 1979. 4 Fig, 8 Tab, 8 Ref.

Descriptors: *Heavy metals, *Oysters, *Clams, *Seasonal, Cadmium, Copper, Iron, Mercury,

Nickel, Zinc, Sodium, Potassium, Calcium, Magnesium, Commercial shellfish, Spectrophotometry, Chemical analysis, *Tissue analysis, *Taiwan.

For the purpose of finding out the chemical properties of oysters and clams cultured in Taiwan, the contents of the major elements, Na, K, Ca, Mg and heavy metals, Cd, Cu, Fe, Hg, Ni, Pb and Zn in these shellfishes were investigated. Shucked oysters and marketed clams were collcted from 7 stations along the west coast of Taiwan from April 1976 to February 1977. The mean concentraions of Na, K, Ca and Mg were found to be 233, 187, 34.3 and 35.3 mg/100 g, respectively. The one that had the most interesting seasonal variation among these major elements was Na in oysters. It was found that the seasonal changes of Na and glycogen in oysters were almost identical. The heavy metal concentration in Taiwan's oysters and clams could be divided into two groups. The group which had higher concentrations consisted of Zn, Fe and Cu, the mean concentraions in oysters being 120.4, 86.1 and 20.4 ppm, and in clams being 14.9 136.1 and 5.7 ppm. The other group which had lower concentrations consisted of Pb, Ni, Cd and Hg, the mean concentrations in oysters being 1.29, 0.55, 0.11 and 0.01 ppm, and in clams being 1.53, 1.09, 0.09 and 0.02 ppm, respectively. These contents of heavy metals were not higher than the 'normal' levels and should not constitute a hazard for consumers. (Deal-EIS)
W80-02991

CHEMICAL COMPOSITION OF TAIWAN'S OYSTERS AND CLAMS,
Kaohsiung Inst. of Marine Technology (Taiwan).
S-S. Jeng, S-Y. Hsu, and G-S. Wang.
Bulletin of the Institute of Zoology, Academia Sinica, Vol 18, No 1, p 1-10, 1979. 3 Fig, 8 Tab, 16 Ref.

Descriptors: *Oysters, *Clams, *Chemical analysis, Estuaries, Commercial shellfish, Proteins, Lipids, Seasonal, Annual, Foods, Chemical properties, *Tissue analysis, *Taiwan.

Chemical composition of Taiwan's oysters crassostrea gigas and clams Meretrix lusoria were investigated to learn the relation between chemical composition and growing conditions, and food quality of the shellfishes. Shucked oysters and marketed clams were collected bi-monthly from 7 major culture areas along the west coast of Taiwan from April 1976 to February 1977. Moisture, protein, lipid, glycogen and ash contents were analyzed. It was found that the market size of taiwan's osyter meat was quite small, 1.18-1.73 g, and the market size of clams with shells was 9.0-27.5 g with an average of 16.5 g,. The sizes of thse two shellfishes were all larger in april-September than in October-February. One of the characteristics of chemical composition of Taiwan's oysters was that, compared with oysters of other countries, the protein concentration was higher, while the glycogen concentraton was lower. The glycogen content of oysters reached its maximum in June-July, and became the lowest in the end of December. The general composition of clams was similar to that of oyster. The reason why oysters and clams were larger and had higher glycogen and ash contents in summer may be due to the fact that there is much river water flowing into the coastal area during that period. (Deal-EIS)
W80-02992

5B. Sources Of Pollution

POLLUTION ASSESSMENT AND POTENTIAL MOBILITY OF HEAVY METALS IN GREAT LAKES SEDIMENTS,
Michigan Univ., Ann Arbor. Dept. of Atmospheric and Oceanic Science.
R. M. Owen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-133580, Price codes: A03 in paper copy, A01 in microfiche. Institute of Water Research, Michigan State University, East Lansing, Project Completion Report, October, 1979. 25 p. OWRT A-101-MICH(1), 14-34-0001-9024.

Descriptors: *Heavy metals, Mobility, Iron, Manganese, Chromium, Copper, Zing, *Sediments, Little Traverse Bay, Lake Michigan.

A sequential extraction scheme is utilized to determine the geochemical fractionation of Fe, Mn, Cr, Cu, and Zn in different grain size classes for sediment samples collected from within and around Little Traverse Bay, Lake Michigan. The partitioning of Fe, Cr, and Cu in both sediment and presently-eroding coastal bluff samples are similar. Also, the concentrations of these metals in fine grained particles are not proportional to the increased surface area of these grains compared with larger grain sizes. Both of these results indicate that these metals have undergone little authigenic change since entering the lacustrine environment. However, sediment Zn concentrations are significantly higher than in coastal bluff samples, and also have a different geochemical fractionation. This result is attributed to the precipitation of Zn in authigenic phases. In general, Mn shows relatively little mobility in the bay's oxidizing environment, except in areas where Mn nodules are forming.
W80-02704

POINT AND NON-POINT POLLUTION INFLUENCING WATER QUALITY IN A RURAL HOUSING COMMUNITY,
Oregon State Univ., Corvallis. Water Resources Research Inst.
R. J. Seidler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-133911, Price codes: A05 in paper copy, A01 in microfiche. Report WRRI-64, November 1979. 76 p, 12 Fig, 13 Tab, 27 Ref. OWRT A-045-ORE(1).

Descriptors: *Non-point pollution, *Drinking water, *Rural areas, Bacterial detection, *Potable water, Coliforms, Oak Creek watershed(OR).

The purpose was to analyze the intensity and origin of non-point pollution in protected and unprotected regions of a rural watershed (Oak Creek watershed). The Oak Creek watershed covers an area of 750 ha. The upper (northern) part of the basin drains part of McDonald Forest, a 4450 ha State-owned forest which is undisturbed except for research activities. The lower (southern) part of the basin includes a rural community consisting of 78 homes. Numbers and species of fecal indicator bacteria were studied through the entire watershed. Also, the presence of the intestinal pathogen Salmonella was studied, since the relationship of numbers of indicators and presence of this pathogen do not strictly correlate. Storm events, particularly important in assessing the impact of non-point pollution, were defined in a quantitative fashion at stations along Oak Creek. Finally, the impact of non-point pollution on ground waters serving as drinking water supplies in this modern rural development was studied.
W80-02708

MICROBIOLOGICAL STUDY OF STORM RUNOFF WATERS FROM A 100% RESIDENTIAL AREA IN CANADA,
Canada Centre for Inland Waters, Burlington (Ontario).
B. J. Dutka.
Canadian Research, Vol 10, No 6, p 32, 51-53, November-December 1977. 4 Fig, 3 Tab, 10 Ref.

Descriptors: *Water pollution sources, *Urban runoff, *Canada, *Microorganisms, Storm runoff, Water quality, Cities, Water sampling, On-site investigations, Coliforms, Testing procedures, Streptococcus, Salmonella, Viruses, On-site data collections, Distribution patterns, Residential areas.

Very little data exists on the microbiological composition of Canadian storm water runoffs. This study was undertaken to fill this gap by the collection of baseline data and to study the incidence of pathogens (salmonella, viruses and P. aeruginosa) in storm runoff waters. Routine microbiological samples for coliforms, fecal coliforms, fecal streptococci, P. aeruginosa, fungi, heterotrophs, salmonella/100 ml and Leptospira/100 ml were hand collected at a weir outfall. Total coliform, fecal coliform, fecal streptococcus, Pseudomonas aeruginosa, and fungus density estimates were performed on all samples. It was concluded that: (1) There is no predictable pattern for maximum bacterial population occurrence in storm runoff waters. (2) Pathogens were isolated during all phases of the 240 min studies. Thus, no predictable pattern of pathogen appearance could be established. (3) The unpredictable distribution pattern of peak microbial populations and pathogen incidence would force one to downplay the concept of collecting and treating a specific portion of each storm to decrease the potential health hazards in recipient waters. (4) Infiltration samples continue to be a source of low grade continuous pollution. (5) Studies should be carried out to establish the degree of microbiological loading on the creek and inshore (Lake Ontario) receiving waters, the extent of this loading into the main lake body and the duration of each event's effect (bacterial die-off rate). (Humphreys-ISWS)
W80-02728

SPECTRAL MEASUREMENTS OF OCEAN-DUMPED WASTES TESTED IN THE MARINE UPWELLED SPECTRAL SIGNATURE LABORATORY,
National Aeronautics and Space Administration, Langley Station, VA. Langley Research Center.
W. G. Witte, J. W. Usry, C. H. Whitlock, and E. A. Gurganus.
Available from the National Technical Information Service, Springfield, VA 22161 as N79-31890, Price codes: A03 in paper copy, A01 in microfiche. NASA Technical Paper 1480, September 1979. 32 p, 8 Fig, 4 Tab, 13 Ref, 1 Append.

Descriptors: *Upwelling, *Spectrometers, *Remote sensing, *Waste disposal, *Reflectance, Atlantic Ocean, Laboratory tests, Sewage sludge, Water pollution, Chemical precipitation, Monitoring, Sea water.

Upwelled spectral radiance and reflectance were measured for dilutions of industrial wastes from three sources as part of a study to evaluate the feasibility of remotely monitoring ocean waste dumping. The wastes used for the test came from the American Cyanamid plant in New Jersey, the Dupont (Graselli) plant in New Jersey, and a consortium of pharmaceutical plants in Puerto Rico. Types of wastes include rubber wastes, paper wastes, waste treatment chemicals, organophosphates, insecticides, intermediates, surfactants, dimethylhydroxylamine and anisole production wastes, penicillin and antibiotics production wastes, and organic solvents. Waste samples were mixed with various concentration of artificial seawater. Equipment used included a Xenon arc lamp, a reflecting mirror, a spectrometer, and a 99% diffuse reflector. All of the waste samples formed precipitates when added to the sea water. Overall the samples from the DuPont plant and the Puerto Rican plants did not give upwelled signals significantly different from base water samples. Waste samples from the American Cyanamid plant showed increased reflectance with increasing concentrations for all wavelengths. Also, reflectance decreased as wavelength increased. The tests showed that increased turbidity does not always cause increased inherent reflectance. (Seigler-IPA)
W80-02740

SOME WATERSHED ANALYSIS TOOLS FOR LAKE MANAGEMENT,
Argonne National Lab., IL. Div. of Environmental Impact Studies.
R. K. Rodiek.
In: Lake Restoration, Report No EPA 440/5-79-001, p 85-94, 1979. 4 Fig, 8 Tab, 34 Ref.

Descriptors: *Michigan, *Eutrophication, *Model studies, *Phosphorus, Lakes, Lake stages, Runoff, Watersheds(Basins), Septic tanks, Waste disposal, Water pollution sources, Soil types, Dissolved oxygen, Chlorophyll, Lake shores.

As an alternative to extensive sampling programs, planners and engineers can use a predictive phosphorus budget model to determine the most effi-

cient lake restoration techniques for a eutrophied lake. Model results can be used to choose techniques for restricting phosphorus input or for removing or inactivating phosphorus already in the lake. Lobdell Lake in Michigan is used as an example for model application. Following increased development the lake is experiencing classical eutrophication symptoms such as blue-green algal blooms, oxygen depletion, and an abundance of littoral macrophytes. Local health officials indicate that ineffective and overloaded septic systems are a major factor in the problem. Morphologic and hydrologic data needed for the model include lake drainage area, surface area, lake volume, precipitation, lake evaporation, mean depth, and long-term areal runoff. The model allows for the estimation of all necessary parameters without extensive field research. Phosphorus inputs can be estimated by using average literature values for overland runoff, bulk precipitation, and septic seepage. If results indicate that a reduction of phosphorus loading from septic seepage is needed, alternative collection and treatment facilities would be required. A mapping technique for the identification of soils in the watershed is presented. (See also W80-02773) (Seigler-IPA)
W80-02790

PHOSPHORUS TRANSPORT ACROSS THE SEDIMENT-WATER INTERFACE,
Wisconsin Univ., Madison. Dept. of Civil and Environmental Engineering.
D. E. Armstrong.
In: Lake Restoration, Report No EPA 440/5-79-001, p 169-175, 1979. 1 Fig, 6 Tab, 43 Ref.

Descriptors: *Lake sediments, *Bottom sediments, *Sediment-water interfaces, *Phosphorus, Eutrophication, Aquatic algae, Algal control, Thermal stratification, Organic compounds, Oxidation, Reduction(Chemical), Interfaces, Water pollution, Nutrients.

The transport of dissolved inorganic phosphate (dissolved reactive phosphate) from lake bottom sediments is an important factor in the success of in-lake restoration programs. The physical, chemical, and biological characteristics of a lake system control the rate of phosphate transport. Results from algae incubated with sediments suspended in a phosphorus-free medium show a high degree of correlation between decrease in sediment inorganic phosphorus and increases in algal organic phosphorus. Approximately 50% of the sediment inorganic phosphorus was available to algae probably due to the tendency for an equilibrium in phosphorus concentrations. Nonapatite inorganic phosphorus is mainly associated with the iron in sediments which results in a strong dependence of phophate transport from sediments on the oxidation-reduction status of the sediments. Investigations show high concentrations of dissolved reactive phosphate in the interstitial waters of surface sediments. When compared to phosphate concentrations in the overlying lake water, this shows the potential for a high flux from the bottom sediments. Measurements of phosphorus transport rates show that they increase as temperature increases. It appears that phosphorus internal loading tends to be high for moderate-depth lakes that develop thermal stratification and anoxic conditions in bottom waters. (See also W80-02773) (Seigler-IPA)
W80-02799

SEDIMENT-RELATED FLUVIAL TRANSMISSION OF CONTAMINANTS: SOME ADVANCES BY 1979,
Saskatchewan Dept. of the Environment, Regina. Inland Waters Directorate.
R. J. Allan.
Available from Inland Waters Directorate, Environment Canada, Ottawa, Ontario, Canada K1A 0E7. Scientific Series No 107, 1979. 24 p, 16 Fig, 9 Tab, 51 Ref.

Descriptors: *Wastes, *Fluvial sediments, *Sediment transport, Drainage systems, Sampling, Analysis, Nutrients, Heavy metals, Separation techniques, Rivers, Streams, Great Lakes.

Suspended sediment can be a major transport mechanism for nutrients and contaminants in drainage systems. Bottom sediment pollution has been extensively studied, but until recently suspended sediment has seldom been chemically analysed. Sufficient suspended sediment could not be collected for detailed nutrient and contaminant analysis until the advent of land-based continuous flow centrifuges. This report describes the evolution of this area of investigation and the stage of development reached in Canada as of 1979. Problems of sampling and analytical requirements are discussed. Examples are included of the types of results being obtained by the main Canadian investigators. Relationships between suspended and bottom sediment chemistry are described. Interaction between those involved in sediment surveys for engineering purposes, water quality monitoring, and research into drainage system contaminant transmission is advocated. Such interaction could rapidly extend existing knowledge in this area, critical to pollution control and environmental basin management. (WATDOC)
W80-02843

WATER MOVEMENT IN A LAND TREATMENT SYSTEM OF WASTEWATER BY OVERLAND FLOW,
Army Terrestrial Sciences Center, Hanover, NH. Applied Research Branch.
For primary bibliographic entry see Field 2G.
W80-02853

BIOLOGICAL EVALUATION OF NON-POINT SOURCE POLLUTANTS IN NORTH CAROLINA STREAMS AND RIVERS,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
For primary bibliographic entry see Field 5C.
W80-02871

THE MERRIMACK: DESIGNS FOR A CLEAN RIVER. ANNEX C: CONSULTANT'S INDUSTRIAL WASTEWATER PROFILES.
Weston (Roy F.) Inc., Boston, MA.
For primary bibliographic entry see Field 5E.
W80-02876

EFFECT OF BOTTOM CONDITIONS ON EUTROPHY OF IMPOUNDMENTS,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2H.
W80-02881

A METHOD FOR MODELING THE DEPOSITION OF SULFUR BY PRECIPITATION OVER REGIONAL SCALES,
Argonne National Lab., IL. Atmospheric Physics Section.
B. B. Hicks, and J. D. Shannon.
Journal of Applied Meteorology, Vol 18, No 11, p 1415-1420, November 1979. 2 Fig, 3 Tab, 16 Ref.

Descriptors: *Air pollution, *Rainfall, *Sulfur, *Model studies, Mathematical models, Precipitation(Atmospheric), Pollutants, Path of pollutants, Acids, Cloud physics, Meteorology, Sulfur deposition, Scavenging, Acid precipitation.

Radioactive fallout data suggest that the concentration of pollutants in rainfall, while highly variable, might be described on the average by about an inverse half-power dependence on the amount of precipitation. Recent measurements of sulfur concentrations in summer rainfall collected at Argonne National Laboratory tend to support this contention, as do preliminary results derived from operations of the DOE precipitation chemistry network. The concept was extended to develop a bulk removal rate for airborne total sulfur by precipitation for use in regional dispersion modeling. (Sims-ISWS)
W80-02886

REGIONAL PATTERNS OF CONTAMINANTS (PAH, PESTICIDES AND TRACE METALS) IN SNOW OF NORTHEAST BAVARIA AND THEIR RELATIONSHIP TO HUMAN INFLUENCE AND OROGRAPHIC EFFECTS,
Bayreuth Univ. (Germany, F.R.). Lehrsteuhl fuer Hydrologie.
E. Schrimpff, W. Thomas, and R. Herrmann.
Water, Air, and Soil Pollution, Vol 11, No 4, p 481-497, May 1979. 14 Fig, 4 Tab, 22 Ref.

Descriptors: *Snow, *Pollutants, *Pesticides, *Distribution patterns, Metals, Organic compounds, Wastes, Zinc, Lead, Cadmium, Copper, Aldrin, Dieldrin, Spatial distribution, Regional analysis, Foreign countries, Analysis, Analytical techniques, Pyridine pesticides, Orography, On-site investigations, Foreign research, Areal, *Bavaria, Snow pollution, Carcinogen, Polycyclic aromatic hydrocarbons.

In January 1978, 31 snow samples were collected throughout NE-Bavaria and were analyzed for trace metals (Zn, Pb, Cd, Cu), pesticides (alpha-BHC, Lindane, Aldrin, Dieldrin) and polycyclic aromatic hydrocarbons (PAH) (3,4-benzopyrene, 1,12-benzoperylene, fluoranthene and 3,4-(o-phenylene)-pyrene). The regional pattern of PAH-concentrations can be explained as follows: above urban areas and through orographic uplifting of the air, PAH's are scavenged from the atmosphere by snow. The trace metals and specific conductance show similar regional patterns, although the pattern for Pb is influenced by automobile traffic as well as by glass and ceramic industries. The pesticides show less distinct patterns relative to the other two groups of contaminants. Using multivariate statistics, it was shown that the trace metals with the exception of Pb and the PAH's had regional patterns similar to each other but distinct from the pesticides. Although orography, urbanization, and industries are shown to affect the regional patterns of PAH's and the trace metals, this is not the case for pesticides. They originate from diffuse sources in agricultural and forested lands. (Humphreys-ISWS)
W80-02896

CONCENTRATIONS OF BENZO(A)PYRENE IN THE SEDIMENTS OF SIX WESTERN UNITED STATES LAKES,
Department of Energy, New York. Environmental Measurements Lab.
M. Heit.
Water, Air, and Soil Pollution, Vol 11, No 4, p 447-454, May 1979. 2 Tab, 27 Ref.

Descriptors: *Lakes, *Sediments, *Water pollution sources, *Organic compounds, *Caliornia, *Utah, On-site investigations, Cores, Analysis, Analytical techniques, Data collections, Chromatography, *Los Angeles(CA), *Utah Lake, Carcinogens, Benzo(a)pyrene.

Sections of sediment cores from 6 western United States lakes were analyzed for benzo(a)pyrene, B(a)P, by thin layer chromatography, fluorescence, and gas chromatography-mass spectrometry. The highest concentration, 305 micrograms/kg dry weight, was found in a Los Angeles reservoir. The concentrations of benzo(a)pyrene in the sediment from all the lakes were found to be lower than expected when compared to other values reported in the literature. However, there appears to be some association between the concentration of B(a)P in the sediment and the environment in which the sample was taken. The highest concentrations occurred in the samples from urban Los Angeles, followed by Utah Lake which appears to be affected by a steel mill. Benzo(a)pyrene was probably not detected in the sediment of lakes several miles downwind from two coal fired power stations either because the sampling locations were too far from the stations, or because dilution of the B(a)P by large amounts of sediment entering the lakes from relatively pristine areas occurred. (Humphreys-ISWS)
W80-02898

DEPOSITION OF TRACE METALS IN STREAM SEDIMENTS,
Montana State Univ., Bozeman. Dept. of Chemistry.
G. K. Pagenkopf, and D. Cameron.
Water, Air, and Soil Pollution, Vol 11, No 4, p 429-435, May 1979. 1 Fig, 4 Tab, 20 Ref.

Descriptors: *Water pollution sources, *Metals, *Streams, *Sediments, *Montana, Lead, Cadmium, Copper, Iron, Water pollution, On-site investigations, Natural streams, Analysis, Water quality, Data collections, Industrial wastes, Lead smelter.

Sediment samples were collected downstream from a Pb smelter and analyzed for Cd, Cu, Fe, Pb, and Zn. The concentrations of these trace metals decrease with increased distance from the smelter. The decrease in trace metal content was utilized to provide an indication of how rapidly artificially high levels of trace metals are reduced to the carrying capacity of a natural water. Equilibrium calculations were utilized to predict the water's intrinsic trace metal carrying capacity. The analytical values observed for Prickley Pear Creek, Montana, and rivers of the United States were listed. Agreement between the calculated values and those observed in Prickley Pear Creek is reasonably good. The concentrations of Cd and Pb in United States rivers are considerably less than those calculated and observed in this study area. (Humphreys-ISWS)
W80-02899

PHOSPHORUS INPUTS INTO A STREAM DRAINING AN AGRICULTURAL WATERSHED, II: AMOUNTS CONTRIBUTED AND RELATIVE SIGNIFICANCE OF RUNOFF TYPES,
Massey Univ., Palmerston North (New Zealand). Dept. of Soil Science.
A. N. Sharpley, and J. K. Syers.
Water, Air, and Soil Pollution, Vol 11, No 4, p 417-428, May 1979. 5 Tab, 31 Ref.

Descriptors: *Agricultural watersheds, *Water pollution sources, *Phosphorous, *Runoff, Streams, Bank erosion, Streamflow, Subsurface runoff, On-site investigations, Sediments, Water quality, Pastures, Data collections, Surface runoff, Water pollution, Foreign research, *New Zealand.

The amounts of P-forms transported in surface, accelerated subsurface, and subsurface runoff, and the stream draining a 20 ha area of a pasture watershed were measured for 3 years. Stream-bank erosion and resuspension of stream sediment contributed the major proportion of the particulate P(PP), total P, and sediment transported annually in stream flow (86, 77, and 74%, respectively). In addition, 29% of the annual dissolved inorganic P(DIP) loading of the stream in 1977 was attributed to the release of P from suspended in situ particulate material. Remarkably similar proportions of water, P forms, and sediment were contributed by the runoff types in each of the 3 years of study. Subsurface runoff contributed the major proportion (67%) of stream flow. Although surface runoff contributed only a minor proportion of stream flow (11%), it contributed the major proportion of both DIP (32%) and PP loading (9%) compared with the other runoff types. Differences in the amounts of P forms transported in the three runoff types can be attributed to several factors, one of the most important being the time of contact between soluble P in runoff waters and soil components. The results obtained in this study suggested that in the watershed under study, the amounts of water discharged and P-forms and sediment transported in surface runoff from the plots were reasonably representative of those from the subwatershed. (Humphreys-ISWS)
W80-02900

SEPTIC TANK WASTEWATER DISPOSAL SYSTEMS AS PHOSPHORUS SOURCES FOR SURFACE WATERS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
R. A. Jones, and G. F. Lee.
Journal of the Water Pollution Control Federation, Vol 51, No 11, p 2764-2775, November 1979. 3 Fig, 6 Tab, 15 Ref.

Descriptors: *Septic tanks, *Effluents, *Phosphorus, *Nutrients, Groundwater, Surface waters, Lakes, Water pollution, Pollutants, Path of pollutants, Sampling, On-site investigations, Monitoring, Wells, Water quality, Hydrology, Groundwater movement, Waste water, Waste water disposal.

A 4-year groundwater monitoring study was conducted in the immediate vicinity of an active septic tank system in northwestern Wisconsin to determine the potential for septic tank effluent to contribute to the excessive fertilization of area surface waters. During the course of this study, movement of septic tank effluent in the groundwater was indicated by measured values of several conservative parameters. However, there was no evidence of the transport of the phosphate from septic tank effluent through the groundwater even at the monitoring point closest to the tile field (about 15 m down groundwater gradient from the tile field). The results of this study confirmed the conclusions drawn from similar studies in other areas reported in the literature, namely, that phosphorus from septic tank wastewater disposal system effluent is usually not readily transported through the groundwater. (Sims-ISWS)
W80-02904

LEACHING OF POLLUTANTS FROM SANITARY LANDFILL MODELS,
Technion-Israel Inst. of Tech., Haifa.
A. Raveh, and Y. Avnimelech.
Journal of the Water Pollution Control Federation, Vol 51, No 11, p 2705-2716, November 1979. 1 Fig, 12 Tab, 16 Ref.

Descriptors: *Leaching, *Landfills, *Laboratory tests, Solid wastes, Leachates, Compaction, Water pollution, Water pollution sources, Groundwater, Temperature, Heavy metals, Nitrogen, Ammonia, Organic matter, Wastes, Pollutants, Path of pollutants, Composting, Sanitary landfills.

The effects of compaction, shredding, composting, and temperature during filling periods on leaching of pollutants from sanitary landfills were studied in columns. The main pollutants detected were organic carbon, volatile organic acids, organic and ammonia nitrogen, and heavy metals. A good correlation was found between the decrease, with time, of the concentration of pollutant and an exponential equation $c = ab$ to the t power, where c is the concentration, t is the time, while a and b are constants. The decay is fast for nonshredded and loosely packed refuse, probably because of a relatively fast and efficient process of humification. The time span needed for the stabilization of the landfill was calculated to be 3 to 15 years, depending on the different treatments. (Sims-ISWS)
W80-02905

ANOMALIES IN CATION CONCENTRATIONS DURING PERCOLATION OF SIMULATED EFFLUENT THROUGH SAND,
California Inst. of Tech., Pasadena.
J. Uradnisheck, and W. H. Corcoran.
Journal of the Water Pollution Control Federation, Vol 51, No 11, p 2691-2704, November 1979. 16 Fig, 2 Tab, 14 Ref.

Descriptors: *Soil water, *Percolation, *Soils, *Ions, *Laboratory tests, Calcium, Magnesium, Nitrification, Nitrates, Ion exchange, Cations, Sands, Soil water movement, Effluents, Waste water, Bacteria, Solutes, Oxygen, Carbon dioxide.

Periodic increases in concentrations of calcium and magnesium ions during percolation of secondary effluent in spreading basins at Whittier Narrows, California, have caused concern. During the drying period of the spreading cycle, aqueous hydrogen ions are produced by nitrification of adsorbed ammonium ions. Subsequently, calcium, magnesium, sodium, and potassium ions are ion-exchanged by the aqueous hydrogen ions in the soil's interstitial structure. The thin film of solution surrounding the mineral grains then develops a large concentration of dissolved nitrate salts of the alkaline earths. During spreading, the leading edge of solution acquires a temporarily high concentration of alkaline-earth salts by mixing and ion exchange. (Sims-ISWS)
W80-02906

SIMPLIFIED DIURNAL CURVE ANALYSIS,
Hickok (Eugene A.) and Associates, Inc., Wayzata, MN.
J. B. Erdmann.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 105, No EE6, Proceedings Paper 15026, p 1063-1074, December 1979. 4 Fig, 2 Tab, 11 Ref, 2 Append.

Descriptors: *Dissolved oxygen, *Algae, *Oxygenation, *Rivers, Analytical techniques, Photosynthesis, Water quality, Respiration, Oxygen, Diurnal, Correlation analysis, Water pollution, Water pollution effects, *Charles River(MA).

Simplified equations have been developed for analysis of river diurnal curves, or graphs of dissolved oxygen (DO) concentration versus time covering day-long periods, to produce estimates of gross photosynthesis and respiration rates. Reaches with long time of flow between stations can be analyzed because rate of DO change is calculated by Stokes' total time derivative. Application to the Charles River, Massachusetts, demonstrated usefulness of the calculated rates in water quality analysis. The simplified equations produced photosynthesis and respiration rates in good agreement with previously reported rates derived by computerized 'systematic' analysis. Calculated photosynthesis rates correlated with the product of algae times phosphorus concentrations. In the Charles River, photosynthesis dominated over atmospheric reaeration as a source of DO replenishment in late June. (Sims-ISWS)
W80-02913

SEDIMENTS, WATER AND FOOD CHAINS AS SOURCES OF CHLORINATED HYDROCARBONS FOR BENTHIC ORGANISMS IN THE MEDITERRANEAN SEA,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
G. G. Polikarpov, S. W. Elder, G. Fowler, P. Benayoun, and P. Parsi.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de la Mer Mediterranee, Monaceo, 24-27 Novembre 1978, Antalaya, Turkey, p 281-284, 1979. 7 Ref.

Descriptors: *Polychlorinated biphenyls, *Path of pollutants, *Benthic fauna, Organic compounds, Absorption, Worms, Mussels, Shrimp, Water chemistry, Bottom sediments, Chemical properties, Animal metabolism, *Polychaetes, *Depuration, *Bioaccumulation, *Tissue analysis.

The sediment dwelling polychaete worm, Nereis deversicolor, is able to accumulate polychlorinated biphenyls (PCB) from both sediments and sea water. Despite a significantly higher concentration factor for PCBs from water (800) than from sediment (3.5), it is concluded that sediments are the major source of PCBs for worms under the existing concentrations of PCBs in Mediterranean water and sediments. Depuration of PCBs from worms living in an uncontaminated environment follows an exponential function. Experiments with Mytilus galloprovincialis showed that PCBs accumulatedover a period of 97 days are readily lost when the mussels are transferred to clean sea water. The loss of PCBs from the soft tissues of these molluscs amounted to 50% after one day, 91.3% after one month and 99.6% after three months. The benthic shrimp, Lysmata seticaudata, rapidly accumulated PCBs from both food and water. The experimental results clearly indicate that PCBs from both food and water. The experimental results clearly indicate that PCBs in the marine environment are readily cycled through the benthic biota. (Deal-EIS)
W80-02937

LEVELS OF CHLORINATED HYDROCARBONS IN MARINE ANIMALS FROM THE CENTRAL MEDITERRANEAN,
Catania Univ. (Italy). Ist. di Chimica e Chimica Industriale.
V. Amico, G. Impellizeri, G. Oriente, M. Piattelli, and S. Sciuto.
Marine Pollution Bulletin, Vol 10, p 282-284, 1979. 1 Fig, 1 Tab, 4 Ref.

Descriptors: *Pesticide Residues, *DDT, *Polychlorinated biphenyls, *Marine animals, DDE, DDD, Aldrin, Dieldrin, Chlorinated hydrocarbon pesticides, Mussels, Shrimp, Mullets, water Quality standards, Public health, Chemical analysis, *BHC, *Tuna, *Anchovy, *HCB, *Tissue analysis, *Bioaccumulation.

Concentrations of chlorinated hydrocarbons (DDT and metabolites, PCBs, aldrin, dieldrin, HCB and BHCs) have been determined in the tissues of five species of marine animals sampled in selected areas of the central Mediterranean. The species examined were anchovy, striped mullet, tuna, shrimp and mussel. The major contaminants were DDT and metabolites and the industrial PCBs. The concentrations of these compounds were about two order of magnitude below accepted public health standards. (Deal-EIS)
W80-02939

CONTAMINATION OF THE MEDITERRANEAN BLUE AND WHITE DOLPHIN BY ORGANOCHLORINE COMPOUNDS (IN FRENCH),
Institut Scientifique et Technique des Peches Maritimes, Nantes (France).
For primary bibliographic entry see Field 5A.
W80-02940

A SUMMARY OF THE EFFECTS OF URBAN WASTES (MARSEILLE-CORTIOU) ON THE ZOOPLANKTONIC POPULATION OF THE NERITIC ZONE (IN FRENCH).
Groupe Equipe Pollution Pelagique de Marseille (E.P.O.P.E.M.) Aix-Marseille-2 Univ. (France). Lab. d'Hydrobiologie.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de la Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 377-379, 1979. 2 Ref, (English summary).

Descriptors: *Water pollution effects, *Zooplankton, Path of pollutants, *Domestic wastes, Dominant organisms, Sewage effluents, Sewage, Neritic, Mediterranean Sea, Marseille, Environmental effects, Animal populations, Marseille.

Quantitative and qualitative variations of zooplankton have been studied in a neritic area under the influence of Marseille-Cortiou sewage outfall. This area can be divided in four zones: (1) a very polluted one, close to the outfall (500 m) with low populations, (2) a very polluted one (2 km wide) but with a five times higher population density than the first zone, (3) an intermediate one which is a mixing zone, (4) a non polluted zone where restructuring of the zooplanktonic populations happens. (Katz-EIS)
W80-02942

EFFECTS OF THE DEFOLIANT 2-4-5-T ON THE DINOFLAGELLATE PROROCENTRUM MICANS IN CULTURE (IN FRENCH),
Arago Lab., Banyuls-sur-Mer (France).
For primary bibliographic entry see Field 5A.
W80-02945

ACCUMULATION OF MANGANESE IN DONAX TRUNCULUS L. (BIVALVIA),
Modena Univ. (Italy). Inst. of Zoology.
E. Orlando, and M. Mauri.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de la Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 297-299, 1979. 3 Fig, 1 Tab, 4 Ref.

Descriptors: *Manganese, *Path of pollutants, *Clams, Water pollution sources, Bivalves, Chemical wastes, Industrial wastes, Chemical analysis, Spectrophotometry, Metals, *Bioaccumulation, *Tissue analysis, *Donax, *Tuscan coast, Clambrone(Tuscany), Feniglia(Tuscany).

The levels of manganese in Donax collected in two localities of Tuscany, polluted at different degrees, have been determined. Manganese is present for the most part in kidneys. Particulate manganese rather than soluble metal seems to have a higher importance so far as the accumulation of manganese in Donax is concerned. Manganese contents in clams from Calambrone was as high as 16 ppm. (Deal-EIS)
W80-02949

THE ROLE OF ZOOPLANKTON FECAL PELLETS IN TRANSPORTING PCBS FROM THE UPPER MIXED LAYER TO THE BENTHOS,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
S. W. Fowler, L. F. Small, D. L. Elder, Y. Unlu, and J. LaRosa.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de la Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 289-291, 1979. 8 Ref.

Descriptors: *Zooplankton, *Polychlorinated biphenyls, *Path of pollutants, Copepods, Pesticide kinetics, Benthos, Vertical migration, Organic compounds, chemical analysis, Water chemistry, Suspended solids, Fecal pellets, *Mediterranean Sea.

Field and laboratory studies are under way to assess zooplankton fecal pellet production as a mechanism for the vertical transport of surface-introduced polychlorinated biphenyls. Natural fecal pellets produced by freshly collected copepods were found to have PCB concentrations of 1300 ppb dry weight. Particle collectors moored at 100 m depths were used to trap particulates which contained a large percentage of fecal matter. This material has also been analyzed for PCBs and found to contain relatively high levels, ranging rate from 200 to 710 ppb dry weight. Mass flux estimates for PCBs and sinking rate measurements of copepod fecal pellets support the contention that zooplankton fecal pellets play a major role in the downward vertical transport and biogeochemical cycling of PCBs in the Mediterranean Sea. (Deal-EIS)
W80-02950

ARSENIC FLUX THROUGH MUSSELS AND SHRIMP,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
M. Y. Unlu, and S. W. Fowler.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de la Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 285-287, 1979. 6 Ref.

Descriptors: *Path of pollutants, *Shrimp, *Mussels, *Arsenic radioisotopes, Radiochemical analysis, Tracers, Absorption, Water chemistry, Salinity, Size, Water temperature, Animal metabolism, *Arsenic, *Bioaccumulation, *Tissue analysis.

Arsenic-74 was used to study various aspects of bioaccumulation and loss of arsenic in Mediterranean mussels (Mytilus galloprovincialis) and benthic shrimp (Lysmata seticaudata). Over a concentration range from 2 to 100 microgr As/l uptake increased as the arsenic concentration in water increased, however, the response was not proportional. Arsenic uptake was inversely related to salinity in both species. Animal size and temperature also affected the arsenic accumulation pattern to some degree. In the case of mussels most of the arsenic accumulated was located in the soft parts. The fraction of total arsenic accumulated in shrimp exoskeleton and muscle was roughly the same (N30-50%). (Deal-EIS)
W80-02951

BIOACCUMULATION FROM WATER AND ELIMINATION OF VANADIUM IN SELECTED MARINE INVERTEBRATES,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
For primary bibliographic entry see Field 5A.
W80-02952

BIOTRANSFORMATION OF BENZO(A)PYRENE BY LITTLE SKATE HEPATIC MICROSOMES-STIMULATION AND RECONSTITUTION OF BENZO(A)PYRENE HYDROXYLASE ACTIVITY,
Middle East Technical Univ., Ankara (Turkey). Dept. of Life Sciences.
E. Arinc, R. J. Pohl, J. R. Bend, and R. M. Philpot.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de la Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 273-276, 1979. 2 Fig, 1 Tab, 10 Ref.

Descriptors: *Enzymes, *Pesticide toxicity, *Fish physiology, Biochemistry, Animal metabolism, Pesticide residues, Organic compounds, Biodegradation, Chemical analysis, 2, 4, 5-T, *TCDD, *3MC, *Biotransformation, *Tissue analysis.

Upon pretreatment of skates with 3-methylcholanthrene (3MC) and TCDD, skate hepatic benzo(a)pyrene hydroxylase activity increased about 8 to 18 fold, respectively. The hepatic microsomal benzo(a)pyrene hydroxylase activity of skates was solubilized and separated into its component parts. Cytochrome P-450, NADPH-cytochrome c reductase, and lipid fractions were required in order to reconstitute microsomal benzo(a)pyrene hydroxylase activity. (Deal-EIS)
W80-02953

COMPARISON BETWEEN THE HG BODY BURDEN OF THYNNUS THYNNUS FROM THE MEDITERRANEAN AND THE ATLANTIC,
Siena Univ. (Italy). Lab. di Idrobiologio.
For primary bibliographic entry see Field 5A.
W80-02954

PCBS AND CHLORINATED PESTICIDES IN ORGANISMS FROM THE LIGURIAN SEA,
Genoa Univ. (Italy). Ist. di Chimica Generale.
V. Contardi, R. Capelli, T. Pellacani, and G. Zanicchi.
Marine Pollution Bulletin, Vol 10, p 307-311, 1979. 1 Fig, 7 Tab, 17 Ref.

Descriptors: *Pesticide residues, *Marine animals, DDT, Polychlorinated biphenyls, DDE, Aroclors, DDD, Chemical analysis, Pesticide kinetics, Chlorinated hydrocarbon pesticides, Gas chromatography, Mussels, Biodegradation, Mullets, Shrimp, *BHC, *Tissue analysis, *Bioaccumulation, *Mediterranean Sea, *Anchovy.

The concentrations of BHCs, DDTs and PCBs have been determined in samples of Engraulis encrasicholus, Mytilus galloprovincialis, Nephrops norvegicus, Mullus barbatus, Euthymnus alletteratus and Sarda sarda, collected in different stations of the Ligurian Sea. Increasing levels of contamination were found in the order: Nephrops, Mytilus and Engraulis, Mullus and Euthymnus, Sarda. A comparison with the data available in the literature relevant to Mytilus samples collected in Genoa in 1973-74 showed a notable decrease in the concentration of chlorinated residues. (Deal-EIS)
W80-02955

RELATIONSHIP OF CADMIUM-INDUCED HYPOCALCEMIA WITH MORTALITY IN RAINBOW TROUT (SALMO GAIRDNERI) AND THE INFLUENCE OF TEMPERATURE ON TOXICITY,
Concordia Univ., Montreal (Quebec). Dept. of Biological Sciences.
M. Roch, and E. J. Maly.
Journal of the Fisheries Research Board of Canada, Vol 36, No 11, p 1297-1303, 1979. 3 Fig, 1 Tab, 30 Ref.

Descriptors: *Rainbow trout, *Toxicity, *Cadmium, *Water temperature, Calcium, Fish physiology, Animal metabolism, Mortality, Heavy metals, Mode of action, Magnesium, Growth stages, *Tissue analysis, *Blood chemistry, Acclimation.

Cold-acclimated (6C) rainbow trout, exposed to lethal concentrations of cadmium, survived longer

than warm-acclimated (12 and 18C) trout. Ten-day lethal thresholds indicated that cold-acclimated trout could also resist greater concentrations of cadmium. Calcium concentrations in the plasma of fish, exposed to 0.3 mg Cd/l, declined steadily during the period of exposure when subjected to five thermal regimes, different combinations of acclimation and experimental temperatures. The rate of decline in calcium concentrations was correlated with the rate of mortality. Survival times of 12C-acclimated trout subsequently exposed to cadmium at 6, 12, and 18C were inversely dependent on temperature, whereas survival times of trout acclimated to 6, 12, and 18C and subsequently exposed to cadmium at acclimation temperatures do not show the same temperature dependence. Survival times of 12 and 18C-acclimated and exposed fish were similar, indicating that temperature compensation may promote longer resistance of 18C-acclimated and exposed fish than when they are acclimated to 12C and abruptly transferred and exposed to cadmium at 18C. Symptoms of cadmium poisoning of the fish are consistent with the effects of extreme hypocalcemia and are similar to those reported in the literature for various fish. The decline of calcium concentrations in the plasma may be the direct cause of mortality. (Deal-EIS)
W80-02956

FLUORIDE IN ANTARCTIC KRILL (EUPHAUSIA SUPERBA) AND ATLANTIC KRILL (MEGANYCTIPHANES NORVEGICA),
Havforskningsinstitutt, Bergen (Norway). Inst. of Vitamin Research.
For primary bibliographic entry see Field 5A.
W80-02957

TEMPERATURE INFLUENCE ON BASAL ACTIVITY AND INDUCTION OF MIXED FUNCTION OXYGENASE ACTIVITY IN FUNDULUS HETEROCLITUS,
Woods Hole Oceanographic Institution, MA. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-02958

ESTIMATING RATE CONSTANTS FOR THE UPTAKE AND CLEARANCE OF CHEMICALS BY FISH,
Dow Chemical Co., Midland, MI. Environmental Sciences Research Lab.
W. B. Neely.
Environmental Science and Technology, Vol 13, p 1506-1510, 1979. 2 Fig, 4 Tab, 16 Ref.

Descriptors: *Mathematical models, *Fish physiology, *Chemical properties, Analytical techniques, Estimating, Path of pollutants, Absorption, Animal metabolism, Perches, Rainbow trout, Brook trout, Brown trout, Lake trout, Organic compounds, Model studies, D1-2-ethylhexylphthalate, DEHP, Chlorpyrifos, 2, 3, 7, 8, Tetrachlorodibenzo-p-dioxin(TCDD).

With the increased need for predicting the movement and distribution of chemicals in an aquatic environment, knowledge of the rate constants governing the uptake and clearance of chemicals in fish is required. In the absence of experimental data, a method is proposed for making reasonable estimations of these two rate constants based on the physiology of the fish and the properties of the chemical. The credibility of the proposal is demonstrated by comparing predicted rate constants with values measured in the laboratory. (Deal-EIS)
W80-02959

EXAMINATION OF PHOSPHORUS CYCLING AND CONTROL OF PHYTOPLANKTON DYNAMICS IN LAKE ONTARIO WITH AN ECOLOGICAL MODEL,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
For primary bibliographic entry see Field 5A.
W80-02962

FLUXES OF DISSOLVED AND PARTICULATE CALCIUM IN SELECTED TISSUES OF CRASSOSTREA VIRGINICA,
Delaware Univ., Lewis. Marine Studies Complex.
L. V. Sick, C. C. Johnson, and C. A. Siegfried.
Marine Biology, Vol 54, p 293-299, 1979. 2 Fig, 4 Tab, 21 Ref.

Descriptors: *Oysters, *Calcium, *Animal metabolism, Absorption, Animal behavior, Metabolism, Nutrient requirements, Tracers, Phytoplankton, Chemical properties, Shellfish, Animal physiology, Water chemistry, *Tissue analysis, *Bioaccumulation.

Rates of calcium incorporation by selected tissues of Crassostrea virginica increased in a step-wise fashion from lowest values among organisms exposed to ambient total calcium concentrations of 45 mg/l, intermediate values among oysters exposed to 135, 225, and 315 mg/l, to highest rates for oysters exposed to 360 mg/l. Although excised visceral mass tissue had highest rates of calcium incorporation relative to mantle, muscle, and both organic and inorganic portions of the shell, mantle tissue appeared to have the most dynamic response to changes in ambient calcium concentrations. Rates of dissolved calcium incorporation from ambient water were approximately two to three orders of magnitude higher than comparable rates from ingested algal food. Behavioral response to concentrations of selected ionic species in the ambient environment may have been responsible for observed differences in rates of calcium incorporation. (Deal-EIS)
W80-02966

EFFECTS OF OIL TRANSFERRED FROM INCUBATING GULLS TO THEIR EGGS,
Fish and Wildlife Service, Victoria, TX. Gulf Coast Field Station.
K. A. King, and C. A. Lefever.
Marine Pollution Bulletin, Vol 10, p 319-321, 1979. 1 Tab, 14 Ref.

Descriptors: *Oil, *Path of pollutants, *Bird eggs, *Gulls, Oil pollution, Nests, Hatching, Mortality, Embryonic growth stage, Incubation, Reproduction, Texas, Animal behavior.

No. 2 fuel oil, or water, was applied to the breast feathers of incubating laughing gulls trapped at their nest site on an island colony in Texas. Gulls were released after treatment and allowed to incubate their eggs for 5 days. Oil was transferred from the feathers of incubating adults to their eggs and resulted in 41% embryo mortality compared with 2% in controls. (Deal-EIS)
W80-02967

TRACE METALS IN FUCOID ALGAE AND PURPLE SEA URCHINS NEAR A HIGH ARCTIC LEAD/ZINC ORE DEPOSIT,
British Columbia Research Council, Vancouver.
A. Bohn.
Marine Pollution Bulletin, Vol 10, p 325-327, 1979. 2 Fig, 2 Tab, 7 Ref.

Descriptors: *Trace elements, *Algae, *Baseline studies, Mining, Lead, Zinc, Metals, Iron, Metabolism, Copper, Absorption, Trophic level, Food webs, Canada, Cadmium, Physiology, *Arsenic, *Sea urchins, *Tissue analysis, *Bioaccumulation.

Seaweed and urchins accumulate Fe and Zn to higher concentrations near a lead/zinc ore body than further away. The concentration of three metals (Cu, Fe and Zn) in seaweed increase with age of tissue. As and Cd are lowest in tissue of intermediate age, suggesting a reversible bonding mechanism for the two elements. Concentrations of Fe in whole urchins, and Zn in the gonads, are higher than concentrations in Fucus tips, which represent a lower level in the food web. Fe is higher in whole sea urchins than in their gonads. For As and Zn the relationship is reversed. (Deal-EIS)
W80-02969

DDTS IN MARINE FISHES FOLLOWING TERMINATION OF DOMINANT CALIFORNIA INPUT: 1970-77,
California Univ., Los Angeles. Dept. of Environmental Science and Engineering.
P. E. Smokler, D. R. Young, and K. L. Gard.
Marine Pollution Bulletin, Vol 10, p 331-334, 1979. 1 Fig, 4 Tab, 11 Ref.

Descriptors: *DDT, *Pesticide residues, *Marine fish, Perches, Bass, Pesticide kinetics, Persistence, Chlorinated hydrocarbon pesticides, Sewage effluents, Bottom sediments, DDD, DDE, Outlets, Fish physiology, Food habits, *Sole, *Tissue analysis, *Bioaccumulation.

Through source control, total DDT annual emissions from the Los Angeles County Sanitation Districts' submarine outfalls decreased by a factor of 30 between 1971 and 1977. Here we report persistent elevated levels of DDT residues measured in three species of marine fishes with distinctly different feeding habits. Over the study interval, median levels of DDT residues have decreased 3-fold (8-fold and 4-fold from peak medians) in flesh of black perch and kelp bass. However, there was no apparent decrease in Dover sole. The sediment reservoir is the likely source of persistent contamination of fishes in the discharge area. (Deal-EIS)
W80-02971

MERCURY CONTENT OF SHARK FROM SOUTH-WESTERN AUSTRALIAN WATERS,
Western Australia Dept. of Fisheries and Fauna, Perth. Marine Research Labs.
For primary bibliographic entry see Field 5A.
W80-02972

MAJOR DETOXIFICATION PATHWAYS FOR PENTACHLOROPHENOL IN GOLDFISH,
Kyushu Univ., Fukuoka (Japan). Lab. of Fisheries and Chemistry.
For primary bibliographic entry see Field 5A.
W80-02973

A CULTURE STUDY OF SALINITY RESPONSES IN ECOTYPES OF TWO ESTUARINE RED ALGAE,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Botany.
For primary bibliographic entry see Field 5A.
W80-02974

EFFECTS OF ARSENIC SPECIATION AND PHOSPHATE CONCENTRATION ON ARSENIC INHIBITION OF SKELETONEMA COSTATUM (BACILLARIOPHYCEAE),
Skidaway Inst. of Oceanography, Savannah, GA.
For primary bibliographic entry see Field 5A.
W80-02975

RECYCLING OF METABOLIZED IRON BY THE MARINE DINOFLAGELLATE AMPHIDINIUM CARTERAE,
Oregon State Univ., Corvallis. School of Oceanography.
B. E. Frey, and L. F. Small.
Journal of Phycology, Vol 15, p 405-409, 1979. 3 Fig, 20 Ref.

Descriptors: *Dinoflagellates, *Metabolism, *Iron, Phytoplankton, Growth rates, Hydrogen ion concentration, Cytological studies, Nutrient requirements, Recycling, Herbivores, Trophic level, Cycles, Seasonal, Bioassay, *Amphidinium.

Senescent, iron-limited cultures of Amphidinium carterae Hulburt were used to detect the presence of iron made available for phytoplankton growth by recycling of metabolized iron from disrupted cells. Both physical disruption of cells and physical disruption plus exposure to a low pH were tested. The test cultures remained viable over long periods of time, and were stimulated to full growth by the addition of Fe, but not by the addition of any other nutrients. Simple physical disruption of cells caused only a very slow release of available Fe, while disruption of cells plus exposure to a low pH

resulted in a rapid release of available Fe. It is suggested that the digestive processes of herbivores are instrumental in the rapid regeneration of Fe as a nutrient available for phytoplankton growth. (Deal-EIS)
W80-02976

DISTRIBUTION OF ESSENTIAL AND TOXIC METALS IN THE TERRESTRIAL GASTROPOD ARION ATER,
University Coll. of Wales, Aberystwyth. Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-02981

ORGANOCHLORINE PESTICIDES AND POLYCHLORINATED BIPHENYLS IN BIRD EGGS FROM THE FALKLAND ISLANDS AND NORTH GERMANY, (IN GERMAN),
Hamburg Univ. (Germany, F. R.). Zoologisches Inst.
H. Hoerschelmann, K. Polzhafer, K. Figge, and K. Ballschmiter.
Environmental Polluton, Vol 13, p 247-269, 1979. 4 Fig, 7 Tab, 20 Ref. (English abstracts).

Descriptors: *Pesticide residues, *Bird eggs, *Path of pollutants, Chlorinated hydrocarbon pesticides, Polychlorinated biphenyls, DDT, DDD, DDE, Endrin, Aldrin, Dieldrin, Pesticide kinetics, Waterbirds, Duck, Gulls, *Heptachlor, *HCB, Methoxychlor, *Tissue analysis, Falkland Islands, North Sea, North Germany.

The content of organochlorine pesticides and polychlorinated biphenyls of 46 eggs of sea, coastal and some inland birds and 47 eggs of comparable north German species was determined quantitatively. The concentration of organochlorine pesticides and polychlorinated biphenyls in eggs from the Falkland Islands was found to be an order of magnitude lower than those in the eggs of comparable north German species. It is suggested that the levels of pesticides found in eggs from these isolated islands reflect the general global contamination level. In contrast with Europe, where the situation is very complex, the consequences of individual changes in local industry and society can be clearly followed in the contamination levels of the eggs. (Deal-EIS)
W80-02982

DISTRIBUTION OF COBALT 60 IN A MOLLUSC, A CRUSTACEAN AND A FRESHWATER TELEOST: VARIATIONS AS A FUNCTION OF THE SOURCE OF POLLUTION AND DURING ELIMINATION,
CEA Centre d'Etudes Nucleaires de de Cadarache, Saint-Paul-les Durance (France). Dept. de Protection.
For primary bibliographic entry see Field 5A.
W80-02984

MECHANISM OF DDT RESISTANCE IN LARVAE OF THE MOSQUITO AEDES AEGYPTI L.; THE EFFECT OF DDT SELECTION,
Victoria Univ. of Manchester (England). Dept. of Zoology.
A. E. McDonald, and R. J. Wood.
Pesticide Science, Vol 10, p 383-388, 1979. 4 Fig, 2 Tab, 2 Ref.

Descriptors: *Mosquitoes, *DDT, *Pesticide toxicity, *Resistance, *Aquatic insects, Genetics, Adaptation, Animal metabolism, Biodegradation, Pesticide kinetics, Chlorinated hydrocarbon pesticides, Insecticides, Insects, DDE, Larval growth stage, Pesticide residues, Absorption.

Selection with pp'-DDT was applied to fourth-stage larvae of Aedes aegypti along four lines, starting with larvae of the F2 generation from crosses between a susceptible strain and each of four resistant strains. Larval resistance increased substantially along each line but there was little or no change in the percentage breakdown of DDT to pp'-DDE in vivo and in no line were these two variables significantly correlated. Percentage breakdown was generally higher at 10 mg than at 50 mg/litre. DDT uptake (defined as content of DDT+pp'-DDE) was generally higher after exposure to 50 mg than to 10 mg/litre. The amount of internal residual (unmetabolised) DDT tolerated by larvae of the TExNS line also increased significantly with resistance. The levels in the other lines followed the pattern of uptake, remaining steady in T8xNS despite the increase in survival, rising at first and then declining in the two Bangkok lines. Thus selection produced a higher tolerance to internal unmetabolised DDT in the two Trinidad lines but led ultimately to a lower content of DDT+pp'-DDE in the two Bangkok lines. The reasons for this behaviour are discussed. (Deal-EIS)
W80-02985

OXYGEN CONSUMPTION AND THE RESPIRATORY RESPONSES TO DECLINING OXYGEN TENSION IN THE CRAB EBALIA TUBEROSA (PENNANT) (CRUSTACEA: DECAPODA: LEUCOSIIDAE),
Marine Biological Station, Millport (Scotland).
For primary bibliographic entry see Field 5A.
W80-02986

MECHANISMS OF DDT RESISTANCE IN LARVAE OF THE MOSQUITO AEDES AEGYPTI L.,
Victoria Univ. of Manchester (England). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-02987

THE OCCURRENCE AND SEASONAL VARIATIONS OF NA, K, CA, MG AND HEAVY METALS IN TAIWAN'S OYSTERS AND CLAMS,
Taiwan Provincial Coll. of Marine Science and Technology, Keelung.
For primary bibliographic entry see Field 5A.
W80-02991

THE CARBON BALANCE IN AN EXPERIMENT REGARDING THE BACTERIAL BIODEGRADATION OF A TOPPED CRUDE OIL (IN FRENCH),
Laboratoire de Cryptogamie du MNHN, Paris (France).
J. Oudut.
Environmental Pollution, Vol 13, p 177-187, 1979. 3 Fig, 7 Tab, 24 Ref, (English Abst).

Descriptors: *Microbial degradation, *Oil, *Soil bacteria, Biodegradation, Chemical reactions, Chemical analysis, Gas chromatography, Aromatic compounds, Organic compounds, Biomass, Carbon dioxide, *Crude oil.

The relative percentage of the different forms of hydrocarbons in an in vitro crude oil biodegradation experiment was determined. Oil was cultured with soil bacteria at 25C for 21 days. The abiotic loss (evaporation) was estimated to be 20% of the initial carbon and the global biodegradation, comprising total and primary biodegradation, reached 21%. The total biodegradation included the carbon transformation into CO2 (mineralisation) and into biomass, estimated respectively at 13.7 and 5.6% of the initial carbon. The primary biodegradation, as measured by the organic carbon dissolved in the medium, represented 1.5% of the initial carbon. Another estimation of the global biodegradation, independently obtained by the residual weight of the chloroform extract, gave a similar result (22%). An analysis of the chloroform-extracted residue, performed by column fractionation and gas-liquid chromatography, showed that the saturate fraction was 40% degraded and the aromatic fraction, 18%. The pristane and phytane were completely biodegraded and no increase of long chain paraffins was noted. A statistically highly significant absolute increase of the asphaltic fraction, due to accumulation of extracellular products, was shown. (Deal-EIS)
W80-02993

A THREE-DIMENSIONAL MODEL FOR ESTUARIES AND COASTAL SEAS: VOLUME VI, BRISTOL BAY SIMULATIONS,
RAND Corp., Santa Monica, CA.
S. Liu, and J. J. Leendertse.
Rand Publications Series Report No-R-2405-NOAA, September 1979. 127 p, 98 Fig, 1 Tab, 13 Ref, 6 Append. 03-022-35249.

Descriptors: *Computer models, *Continental shelf, *Tidal waters, *Oil spills, Wind tides, Simulation analysis, Bays, Currents(Water), Ocean currents, Drifting(Aquatic), Movement, Water circulation, Diurnal, Isotherms, Mapping.

Tide and wind effects in St. George Basin and Bristol Bay in the Bering Sea were simulated by use of a three-dimensional model. The model will serve as a basis for predicting oil spill trajectories and risk analysis for proposed oil lease sites in the area. Surface drift by which oil spills are dispersed is difficult to predict in the area due to strong tide dominance and consistent vertical nonhomogeneity in the current and density fields. Because of these complicated wind and tidal forces a three-dimensional model rather than a two-dimensional model was developed. Procedures for model setup, adjustments, and a verification run are presented. Field data were used to determine bottom stress coefficients and constants for the turbulence-closure computation. Extensive graphical representations were possible because many plotting programs were already available in two-dimensional systems. Predicted tides at the open boundaries were used to drive the model for the verification run. To evaluate the model computed current distributions were compared to observed values with good agreement. Overall the model is a good basis for predicting bay response to wind, tide, and local density variations. (Seigler-IPA)
W80-02999

5C. Effects Of Pollution

APPLICATION OF LINEAR POLARIZATION TECHNIQUES TO THE STUDY OF CARBON STEEL CORROSION IN DILUTE AMMONIUM NITRATE SOLUTIONS AND IRRIGATION GROUNDWATERS,
Nebraska Water Resources Center, Lincoln.
D. L. Johnson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-133903, Price codes: A02 in paper copy, A01 in microfiche. Project Completion Report, September 1, 1979. 20 p, 9 Fig, 5 Tab, 6 Ref. OWRT A-046-NEB(1).

Descriptors: *Corrosion, *Irrigation, *Distribution systems, *Ammonium compounds, *Nitrates, Water pollution effects, Polarity, Nebraska, Anions, Mathematical models, Steel, Potentiometers, Nitrogen compounds, Herbicides, Insecticides, Groundwater.

Linear polarization measurements were used to predict corrosion rates for low carbon 1018 steel, a material commonly used in irrigation structures and electrical components. Corrosivity was determined as a function of ammonium nitrate which is commonly distributed to fields through irrigation systems. Both dilute ammonium nitrate solutions and corrosive groundwater field samples from wells in central Nebraska were tested. No ammonium nitrate was added to the field samples. Dual potentiostat systems, a PAR system with a Corning test cell for anodic polarization and an Aardvark system with a modified test cell for linear polarization were used. Corrosion rate data were based on 1018 steel weight change as a function of time and ammonium nitrate concentration. Results show a good correlation between potentiodynamic anodic polarization, linear polarization, and weight change data. Also, corrosion rates for carbon steel (and copper) increase substantially as ammonium nitrate concentration increases. The linear polarization technique was found to be a useful method for testing material suitability for use in irrigation systems. Polarization graphs are presented for the various samples and conditions tested. (Seigler-IPA)
W80-02709

PHYSIOLOGICAL AND BEHAVIORAL CHANGES IN WILD WATERFOWL EXPOSED TO CONCENTRATED SALT WATER,
Colorado State Univ., Fort Collins. Dept. of Physiology and Biophysics.
R. A. Herin, D. H. Will, and E. A. Fountain.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 390, Price codes: A06 in paper copy, A01 in microfiche. Final Project Report prepared for the Bureau of Reclamation, June 27, 1979. 109 p, 31 Fig, 10 Tab, 96 Ref, 2 Append. 7-07-83-V0704.

Descriptors: *Mallard duck, *Waterfowl, *Salt tolerance, *Saline water, Birds, Dehydration, Animal behavior, Animal physiology, Animal metabolism, Osmosis, Colorado, Colorado River, Water birds, Water pollution effects, Ponds.

Male Mallard ducks (Anasplatyrhynchous) were used in nine experiments to study the effects of exposure to saltwater on waterfowl. A concern for the waterfowl visiting the large diversion saltwater evaporation pools in Paradox Valley, Colorado, prompted the study. Both laboratory and field experiment data on physiological and behavorial effects were correlated to develop methods for counteracting the harmful changes in the birds. Test objects were: (1) to determine the basis and sites of body fluid loss; (2) to determine the basis for decreased body temperature in exposed ducks; and (3) to provide a better definition of exposed wild waterfowl behavioral responses. Results show that severe dehydration occurred after 36 hours in salt water (270,000 ppm) with no food or freshwater. Water was primarily lost through the feet and legs. Increased environmental temperature resulted in greater dehydration. For the first 12 hours of exposure body temperature and metabolism were near normal, however, after that temperature decreased and metabolism increased. Duck behavior was relatively constant with a initial period of high excitability and activity followed by a time of unresponsiveness then finally coma and death. The cause of death is probably respiratory or cardiac failure due to a severe electrolyte imbalance in the blood and hypothermia. The ducks recovered when removed in time from the salt water and provided with a warm dry environment and fresh drinking water. (Seigler - IPA)
W80-02737

THE MODIFICATION OF INLAND WATERS,
J. Cairns, Jr.
In: Wildlife and America Council on Environmental Quality, Washington, D.C. p 146-162, 1978. 3 Fig, 4 Tab, 57 Ref.

Descriptors: *Inland waterways, *Protection, *Preservation, *Environmental effects, Water pollution, Wetlands, Marshes, Thermal pollution, Irrigation, Forest management, Toxins, Dams, Channeling, Ecosystems, Storm runoff, Radioactivity.

The ecological and environmental effects of inland waters modification is discussed. A brief history of modification is provided to illustrate the initial lack of concern for environmental effects. While there is now great concern for the presentation of the quality of inland waters, most citizens still do not fully appreciate or understand the complexity of ecosystems because urbanization has separated them from natural systems. Threats to the integrity of inland waters include point sources, nonpoint sources, toxicants, heated waste water, suspended solids, organic materials, velocity changes, dams, channelization, storm sewers, irrigation, clearcutting and other forestry practices, tainting substances, radioactivity, transport of hazardous cargo, pumped storage reservoirs, and interbasin transfers. Another area of concern is the destruction of valuable wetlands that store flood waters, filter and assimilate dissolved nutrients, stabilize shorelines, and provide a habitat for fish and wildlife. Passage of the Federal Water Pollution Control Act Amendments of 1972 provided some protection for wetlands. More protection for inland waters could be provided by developing inland water quality assurance programs, performing risk analysis for water ecosystems, continuing biological monitoring and promoting water conservation. A system for rewarding good ecological behavior and penalizing bad ecological behavior would also afford some protection. (Seigler - IPA)
W80-02746

ESTIMATING THE HAZARD OF CHEMICAL SUBSTANCES TO AQUATIC LIFE,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
J. Cairns, K. L. Dickson, and A. W. Maki.
Hydrobiologia, Vol 64, No 2, p 151-166, 1979. 2 Fig, 3 Tab, 6 Ref.

Descriptors: *Hazards, *Pesticide residues, *Aquatic life, *Testing procedures, Analytical techniques, Water pollution, Path of pollutants, Water pollution sources, Reproduction, Larvae, Environmental effects, Microenvironment, Mortality, Biological properties, Chemical wastes.

Following the Toxic Substances Control Act (TSCA) the need for hazard assessment procedures such as those devised by the American Society for Testing and Materials (ASTM), the American Institute of Biological Sciences (AIBS), and Monsanto became apparent. A hazard assessment procedure, a sequential series of tests should allow a chemical to be used, banned, or require more extensive testing. The ASTM, AIBS, and Monsanto procedures are designed to evaluate hazards to aquatic life in order to facilitate the registration of pesticides. The ASTM and Monsanto procedures evaluate a broad spectrum of use for any potential aquatic hazard while the AIBS procedure is more pesticide specific. The three procedures are compared on several points including program design, baseline data, decision criteria, options, uncertainty, and environmental levels. Other toxicity tests such as acute lethality, embryo-larval, reproductive, residue accumulation, and several others are ranked by significance. A discussion of the safety factor concept is included. Basically this is a numerical quantity multiplied by the known biological effect concentration. It is concluded that the basic framework for estimating chemical aquatic life hazards has been established. This framework now needs to be applied, refined, and made as cost effective as possible. (Seigler-IPA)
W80-02747

THERMAL DISCHARGE RESEARCH,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
J. Cairns, D. S. Cherry, and S. R. Larrick.
Water Spectrum, Vol 11, No 4, p 1-8, Fall 1979. 11 Fig.

Descriptors: *Powerplants, *Thermal powerplants, *Bioassay, *Aquatic animals, *Thermal pollution, Virginia, Clams, Aquatic environment, Water temperature, Chlorination, Entrainment, Fish behavior, Migration, Coals, Plankton nets.

The Glen Lyn site-specific field laboratory in Virginia and adjacent artificial stream system were used to study the role of powerplant discharges upon the aquatic ecosystem in order to comply with Federal regulations. The assessment included studies of heated waste water, intermittent antifouling chlorination, coal ash effluents, and aquatic organism entrainment or impingement. A fish hatchery trough with a series of 12 250-watt infrared lamps of increasing intensity were used to test temperature preference. After one to three hours of observing fish movements in the trough a preferred temperature could be determined. Temperature and chlorine avoidance were studied in two linear troughs that were filled from opposite ends with river water. Temperature or chlorine levels in one end were raised while the other end remained normal. Levels were raised until a definite avoidance was recorded. A conventional static test and a circulating tank test were used for coal ash bioassays. Sampling baskets and nets were used to study impingement and entrainment effects. Artificial streams were found to be valuable testing tools because they: (1) use natural river water, (2) provide improved simulation of natural or waste water effects, (3) use indigenous flora or fauna, (4) reduce lapse time for holding test fish, and (5) provide a semi-controlled field laboratory arrangement. By using these site-specific techniques that plant was able to show that its operation caused no appreciable harm to the fish populations in the river. (Seigler-IPA)
W80-02748

THE AVAILABILITY OF SEDIMENT PHOSPHATE TO ALGAE,
Hydrological Research Inst., Pretoria (South Africa); and Department of Water Affairs, Pretoria (South Africa).
D. C. Grobler, and E. Davies.
Water S. A., Vol 5, No 3, p 114-122, July 1979. 3 Fig, 7 Tab, 22 Ref.

Descriptors: *Aquatic algae, *Eutrophication, *Phosphates, *Nitrilotriacetic acid, *Bottom sediments, Nutrients, Bioassay, Chemical analysis, Nitrogen, Dams, Water sampling, Reservoirs, Biomass, Separation techniques.

The relationship between the amount of phosphate extracted from sediment by chemical means, and the growth rate of Selenastrum capricornutum in the sediment was examined. Fifteen bottom sediment samples were collected at the Bloemhof Dam with a Birge-Ekman grab. Phosphate availability to algae was tested by using the sediment as the only source of phosphate in nutrient media. Bioassays were done in triplicate and algal biomass was estimated using a version of the Walkley-Black method. Chemical analyses were conducted for cation exchange capacity, total phosphate, inorganic phospha te, organic phosphate, dilute-hydrochloric acid-dilute fluoride extractable phosphate, Kjeldahl nitrogen, and organic carbon. Results show that part of the bottom sediment phosphorous was available for algal growth. Also, algal phosphate consumption showed significant correlation with the amount of phosphate extracted by chemical means (the nitrilotriacetic acid procedure) and with the inorganic phosphate content of the sediment. A non-linear relationship exists between algal available phosphate and inorganic phosphate, while the chemically extracted phosphate and algal available phosphate relationship is linear. Overall sediment-bound phosphate was found to be readily available for algal growth. This could lead to algal growth problems in reservoir areas. The estimation of biologically available phosphate by chemical methods is promising. (Seigler-IPA)
W80-02751

THE USE OF THE WALKLEY-BLACK METHOD FOR ORGANIC CARBON DETERMINATION AS A PROCEDURE FOR ESTIMATING ALGAL YIELDS,
Hydrological Research Inst., Pretoria (South Africa); and Department of Water Affairs, Pretoria (South Africa).
D. C. Grobler, and E. Davies.
Water S. A., Vol 5, No 3, p 138-143, July 1979. 2 Fig, 3 Tab, 21 Ref.

Descriptors: *Aquatic algae, *Biomass, *Bottom sediments, *Carbon, Eutrophication, Nutrients, Aquatic productivity, Primary productivity, Suspended solids, Sediments, Volumetric analysis, Spectrophotometry, Walkley-Black method.

The Walkley-Black method for determining organic carbon in soils was modified and proved to be a successful tool for determining algal biomass in sediment containing waters. The original method estimates organic carbon concentrations by a determination of the amount of dichromate consumed by organic carbon by back titration of excess dichromate with a ferrous solution. The modification use a colorimetric procedure to measure green chromium-III-ion production as a direct measure of organic carbon. Algal biomass determination from the Walker-Black method are compared with biomass determinations from the suspended solids concentration method. Algal culture of Selenastrum capricornutum and microcystis aeruginosa were used for the determinations. Tests were performed in both sediment containing and nonsediment containing cultures. Both methods for determining algal yields had good precision with low coefficients of variation. Also, a good linear

relationship was observed between organic carbon determinations and suspended solids. Advantages of the Walkley-Black method are: (1) it can be used to estimate biomass in sediment containing cultures, (2) it requires less expensive instrumentation, and (3) reqired operator training levels are much lower. (Seigler-IPA)
W80-02753

GENERAL CONCEPTS OF LAKE DEGRADATION AND LAKE RESTORATION,
Maine Univ. at Orono.
P. D. Uttormark.
In: Lake Restoration, Report No EPC 440/5-79-001, p 65-69, 1979. 3 Tab, 6 Ref.

Descriptors: *Eutrophication, *Lake stages, *Nutrients, *Fertilization, Water quality control, Algae, Algal control, Aquatic algae, Aquatic plants, Phosphorus, Nitrogen, Biocontrol, Cycling nutrients, Groundwater, Agricultural runoff, Water pollution, Fallout.

Lake eutrophication is water quality degradation resulting from the direct or indirect effects of excessive fertilization. Excessive fertilization increases the primary productivity of a lake causing excessive growth of algae and rooted aquatic plants. This increased plant growth in turn results in unsightly scums, oxygen depletion, unpleasant water tastes, unpleasant odors, a reduction in recreational and fishing value, and other detrimental effects. Fertilization provides increases in needed plant nutrients such as nitrogen and phosphorus. Most lake restoration actions are designed to reduce the levels of nutrients available in lake surface wastes. Nutrients may come into a lake from either point or nonpoint sources. A point source has a clearly defined unit such as a pipe or a sewage treatment plant outlet. A nonpoint source is a nonspecific area from which nutrients are exported such as croplands. Groundwater, surface water, precipitation, and dry fallout are all transport vectors for nutrients. The nutrient levels in a lake are also dependent on the degree of internal nutrient recycling. Most lakes are nutrient traps storing large amounts of nutrients in bottom sediments. The release of these trapped sediments is seasonal due to thermal stratification. Restoration techniques to limit the amount of nutrients available in a lake fall into three categories: (1) reduction of nutrient inflow, (2) disruption of the internal nutrient cycle, and (3) acceleration of nutrient outflow. An alternate restoration approach is 'biomanipulation', using lake fertility for beneficial biological production such as increased fish populations. (See also W80-02773) (Seigler-IPA)
W80-02787

LAKE MEASUREMENTS,
Michigan State Univ., East Lansing. Inst. of Water Research.
D. L. King.
In: Lake Restoration, Report No EPA 440/5-79-001, p 71-76, 1979. 3 Fig, 39 Ref.

Descriptors: *Eutrophication, *Watershed management, *Water pollution control, Runoff, Storm runoff, Dredging, Phosphorus, Dissolved oxygen, Water quality control, Lakes, Lake stages, Watersheds(Basins), Drainage water, Aquatic plants, Aquatic algae, Project planning.

Preparing a comprehensive plan for the renovation of a nutrient-enriched lake require the collection and interpretation of basic data. Special consideration must be given to lake drainage basin characteristics since the drainage basin largely determines the fate of the lake. The first step in the formulation of a renovation plan is to define the problem. The primary factor in lake water quality problems is increased phosphorus concentration which causes too many algae, too many macrophytes, and too little dissolved oxygen. After the problem has been defined, the source of the problem needs to be identified. This can be accomplished by characterizing the lake, characterizing the drainage basin, and performing calculations based on the characterizations. The next step is the control of the problem. The best control strategy is to reduce phosporus input by controlling runoff from the drainage basin. Control methods include strict zoning, sediment basins on tributaries, greenbelts, diversion, dilution, better stormwater handling, and using porus pavement in urban areas. In-lake control methods include dredging, physical and chemical treatment of sediments, artificial aeration, dilution, biological manipulation, and algae poisoning and harvesting. The cost of preparing a plan is difficult to determine due to the great differences in lakes, lake basins, and lake problems. (See also W80-02773) (Seigler-IPA)
W80-02788

MINE DRAINAGE IMPACT ON WATER QUALITY AND ECOSYSTEM ENERGETICS IN A WESTERN PENNSYLVANIA STREAM,
Illinois Inst. of Tech. Chicago. Pritzker Dept. of Environmental Engineering.
W. J. Mitsch, and R. D. Letterman.
In: Surface Mining and Fish/Wildlife Needs in the Eastern United States, Report No FWS/OBS-78/81 A, p 99-106, 1979. 1 Fig, 4 Tab, 25 Ref.

Descriptors: *Pennsylvania, *Watersheds(Basins), *Mine drainage, *Mine acids, Water pollution, Iron compounds, Ecosystems, Food chains, Food webs, Water sampling, Dissolved oxygen, Energy budget, Turbidity, Water temperature, Sulfates, Environmental effects.

Physical, chemical, and biological components of the Ben's Creek Watershed were measured to assess the impact of acid mine drainage on the watershed. The watershed area is approximately 127 km sq and is a part of the Kiskiminetas drainage basin, a tributary to the Allegheny River. Due to the relatively short mine drainage reach an upstream-downstream study was possible. Ferric hydroxide deposition and ecosystem energetics were calculated for the stream. Weekly water samples were collected from 15 stations from June through August 1976. Samples were analyzed for dissolved oxygen, pH, temperature, alkalinity, acidity, turbidity, total solids, dissolved solids, conductivity, total iron, ammonia nitrogen, hardness, sulfate, and trace metal content. Other areas monitored were flowrate, macroinvertebrate benthic population, and fish types. Samples were also taken at the two main mine drainage outlets, Rock Tunnel and Cauffield Mine. Upstream and downstream food webs and ecosystems were analyzed to estimate equivalent loss of ecosystem energy flow. Results show (1) the pH is only slightly affected near mine discharge areas, (2) acidity does not exceed alkalinity, (3) sulfates increase near mine discharge areas, (4) turbidity increases rapidly near discharge areas then rapidly decreases, and (5) downstream iron content was higher than upstream. (Seigler-IPA)
W80-02810

BIOLOGICAL EVALUATION OF NON-POINT SOURCE POLLUTANTS IN NORTH CAROLINA STREAMS AND RIVERS,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
D. R. Lenat, D. L. Penrose, and K. W. Eagleson.
Biological Series 102, 1979. 168 p, 16 Fig, 51 Tab, 54 Ref.

Descriptors: *Water quality, *Biological studies, *Benthic flora, *Benthic fauna, *Water pollution, *Non-point source pollution, *Aquatic life, *Water pollution sources, *North Carolina, Federal Water Pollution Control Act, Stream pollution, Sedimentation, Runoff, Agricultural runoff, Mining runoff, Habitats, Baseline studies, Rivers, Microorganisms, Biotic index, Shannon-Weiner index.

This study analyzes the effects of non-point source pollution by benthic community counts at points along selected North Carolina mountain and Piedmont streams. The study was undertaken as part of a regionwide Section 208 Water Quality Management Plan. The thesis of the study is that greater benthic community diversity occurs in streams less 'stressed' by sediment, runoff, and toxin loads. Samples were selected at streampoints using the 'kick' method, employing a net positioned on the streambed, while a one square meter area upstream of the net is disturbed. Data were gathered and classified by individual species, taxonomic group, and single individuals. In general, unstressed mountain streams yield richer benthic samples than Piedmont streams. In urban streams near Asheville, Winston-Salem and Raleigh, where urban runoff and toxic wastes present water quality problems, species counts were significantly lower than on unstressed streams. Agricultural development leading to runoff produced low counts mainly near streams in areas with no erosion control and no buffer zones between the activity and the stream. Similarly high levels of sediment input from construction and mining produced low counts for a year after the end of the activity, whereupon community counts began to approach normal levels. (Arnold-NC)
W80-02871

SEDIMENTS, WATER AND FOOD CHAINS AS SOURCES OF CHLORINATED HYDROCARBONS FOR BENTHIC ORGANISMS IN THE MEDITERRANEAN SEA,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
For primary bibliographic entry see Field 5B.
W80-02937

REDUCING LEVELS OF MIREX, AROCLOR 1254, AND DDE BY TRIMMING AND COOKING LAKE ONTARIO BROWN TROUT (SALMO TRUTTA LINNAEUS) AND SMALLMOUTH BASS (MICROPTERUS DOLOMIEUI LACEPEDE),
New York State Dept. of Environmental Conservation, Rome.
J. C. Skea, H. A. Simonin, E. J. Harris, S. Jackling, and J. J. Spagnoli.
Journal of Great Lakes Research, Vol 5, No 2, p 153-159, 1979. 6 Tab, 6 Ref.

Descriptors: *Pesticide residues, *Brown trout, *Smallmouth bass, DDE, DDT, Polychlorinated biphenyls, Aroclors, Foods, Chemical analysis, Lake Ontario, Gas chromatography, Path of pollutants, Chlorinated hydrocarbon pesticides, *Mirex, *Food preparation.

Trimming of Lake Ontario smallmouth bass (Micropterus dolomieui) and brown trout (Salmo trutta) was found to reduce levels of mirex, Aroclor 1254, and DDE by 43% to 64%. trimming included the removal of the skin, doreal and ventral fat, and the entire lateral line. Of the cooking methods tested (smoking, broiling, baking, and deep frying), only deep frying produced consistently high reduction of all three contaminants. (Deal-EIS)
W80-02938

LEVELS OF CHLORINATED HYDROCARBONS IN MARINE ANIMALS FROM THE CENTRAL MEDITERRANEAN,
Catania Univ. (Italy). Ist. di Chimica e Chimica Industriale.
For primary bibliographic entry see Field 5B.
W80-02939

CONTAMINATION OF THE MEDITERRANEAN BLUE AND WHITE DOLPHIN BY ORGANOCHLORINE COMPOUNDS (IN FRENCH),
Institut Scientifique et Technique des Peches Maritimes, Nantes (France).
For primary bibliographic entry see Field 5A.
W80-02940

THE TEMPERATURE AND OXYGEN LETHAL LIMITS OF ACARTIA CLAUSI GIESBRECHT IN A POLLUTED MARINE ECOSYSTEM,
Athens Univ. (Greece). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-02941

A SUMMARY OF THE EFFECTS OF URBAN WASTES (MARSEILLE-CORTIOU) ON THE ZOOPLANKTONIC POPULATION OF THE NERITIC ZONE (IN FRENCH).

Groupe Equipe Pollution Pelagique de Marseille (E.P.O.P.E.M.) Aix-Marseille-2 Univ. (France). Lab. d'Hydrobiologie.
For primary bibliographic entry see Field 5B.
W80-02942

DISTRIBUTION AND EVOLUTION OF BENTHIC POPULATIONS OF THE GULF OF IZMIR (INTERIOR PART) SUBJECTED TO MULTIPLE TYPES OF POLLUTION (IN FRENCH),
Ege Univ., Izmir (Turkey). Dept. d'Oceanographique Biologique.
A. Kocatas.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de la Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 417-421, 1979. 2 Fig, 2 Tab, 3 Ref, (English Summary).

Descriptors: *Water pollution effects, *Benthos, On-site-investigations, Dominant organisms, *Domestic wastes, *Industrial wastes, Mediterranean, *Gulf of Izmir, Turkey, Water temperatures, Dissolved oxygen, Nutrients, Polychaetes, Diversity index, Animal populations.

During a 15 month period (June 1977 - August 1978) physico-chemical parameters and benthic sampling were realized at 10 stations in the interior part of the Gulf of Izmir under the influence of various pollutions. Also, investigations carried out in 1971-1972 and 1974-1975 have permitted us to follow the preliminary evolution of benthic populations of the Gulf. The studies indicate that the benthic populations decline progressively to the east (into the harbor). The interior part of the Gulf of Izmir is practically abiotic. (Katz-EIS)
W80-02943

STUDIES IN REGARD TO DIFFERENT TYPES OF ACTION OF DETERGENTS ON MARINE SPECIES (IN FRENCH),
Centre d'Oceanographie, Marseille (France). Station Marine d'Endoume.
For primary bibliographic entry see Field 5A.
W80-02944

LETHAL AND SUBLETHAL EFFECTS OF MERCURY SALTS ON MONODONTA ARTICULATA,
Royal Univ. of Malta, Valletta. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-02946

NEW DATA ON THE DISTRIBUTION OF POLLUTANTS AND THEIR EFFECT ON SOME HYPONEUSTON CONSTITUENTS IN THE S.E. MEDITERRANEAN,
Alexandria Inst. of Oceanography and Fisheries (Egypt).
For primary bibliographic entry see Field 5A.
W80-02948

ACCUMULATION OF MANGANESE IN DONAX TRUNCULUS L. (BIVALVIA),
Modena Univ. (Italy). Inst. of Zoology.
For primary bibliographic entry see Field 5B.
W80-02949

THE ROLE OF ZOOPLANKTON FECAL PELLETS IN TRANSPORTING PCBS FROM THE UPPER MIXED LAYER TO THE BENTHOS,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
For primary bibliographic entry see Field 5B.
W80-02950

ARSENIC FLUX THROUGH MUSSELS AND SHRIMP,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
For primary bibliographic entry see Field 5B.
W80-02951

PCBS AND CHLORINATED PESTICIDES IN ORGANISMS FROM THE LIGURIAN SEA,
Genoa Univ. (Italy). Ist. di Chimica Generale.
For primary bibliographic entry see Field 5B.
W80-02955

RELATIONSHIP OF CADMIUM-INDUCED HYPOCALCEMIA WITH MORTALITY IN RAINBOW TROUT (SALMO GAIRDNERI) AND THE INFLUENCE OF TEMPERATURE ON TOXICITY,
Concordia Univ., Montreal (Quebec). Dept. of Biological Sciences.
For primary bibliographic entry see Field 5B.
W80-02956

ESTIMATING RATE CONSTANTS FOR THE UPTAKE AND CLEARANCE OF CHEMICALS BY FISH,
Dow Chemical Co., Midland, MI. Environmental Sciences Research Lab.
For primary bibliographic entry see Field 5B.
W80-02959

DIFFERENCE IN TASTE BETWEEN THE RIGHT AND LEFT SIDES OF TAINTED FISH,
Domtar Ltd. Research Centre, Senneville (Ontario).
A. J. Liem, and V. A. Naish.
Journal of the Fisheries Research Board of Canada, Vol 36, p 1412-1413, 1979. 2 Tab, 1 Ref.

Descriptors: *Rainbow trout, *Taste, *Pulp wastes, Fish physiology, Path of pollutants, Commercial fish, Bioassay, Mode of action, Water pollution effects, Chemical wastes, Kraft pulping wastes, *Tainting, *Tissue analysis.

More tainting was found on the left than on the right side of rainbow trout (Salmo gairdneri) that were exposed to a kraft pulp mill 'foul condensate.' This sidedness was deduced from the results of the triangle taste test used to detect differences between exposed and control fish, and was observed when the tainting was moderate, in the range of effluent concentrations of 0.015-0.046% by volume. (Deal-EIS)
W80-02961

HEAVY METALS IN THE NATIVE OYSTER (OSTREA ANGASI) AND MUSSEL (MYTILUS EDULIS PLANULATUS) FROM PORT DAVEY, SOUTH-WESTERN TASMANIA,
Tasmanian Fisheries Development Authority, Taroona.
For primary bibliographic entry see Field 5A.
W80-02963

HISTORIC TRANSFORMATIONS OF FISH COMMUNITIES IN THREE GREAT LAKES BAYS,
Toronto Univ. (Ontario). Inst. for Environmental Studies.
T. H. Whillans.
Journal of Great Lakes Research, Vol 5, No 2, p 195-215, 1979. 7 Fig, 5 Tab, 95 Ref.

Descriptors: *Fish populations, *History, *Great Lakes, Biological communities, Water pollution effects, Habitats, Water temperature, Water circulation, Benthos, Benthic fauna, Bottom sediments, Water quality, Commercial fishing, Adaptation, Silting, Plankton, Water pollution sources, Lake Ontario, Lake Erie, Toronto Bay, Burlington Bay, Inner Long Point Bay.

Fish community transformation is investigated for the period from early settlement to the present in Toronto and Burlington Bays, Lake Ontario, and Inner Long Point Bay, Lake Erie. Extensive historic documentation and interviews are combined as case histories detailing changes in fish communities due to changes in water levels, temperature, shoreline configuration, circulation, inflow, watershed conditions, bathymetry, bottom materials, siltation, water conditions, aquatic macrophytes, plankton, benthic invertebrates, stocked fish, commercial and sport fishing. The most stressful perturbations were shoreline and benthic modifications in Toronto Bay, deteriorating water conditions in Burlington Bay, and exploitation in Inner Long Point Bay. Differences between responses of pelagic migrants and near-shore residents to stress appeared to vary according to preadaptation of the species and the flexibility of its life pathways. The overall transformations of the communities have some similarities between time periods and from community to community. (Deal-EIS)
W80-02964

ENTRAINMENT AND IMPINGEMENT OF FISH BY POWER PLANTS IN THE GREAT LAKES WHICH USE THE ONCE-THROUGH COOLING PROCESS,
Fisheries and Marine Service, Sault Ste. Marie (Ontario). Great Lakes Biolimnology Lab.
For primary bibliographic entry see Field 5A.
W80-02965

EFFECTS OF OIL TRANSFERRED FROM INCUBATING GULLS TO THEIR EGGS,
Fish and Wildlife Service, Victoria, TX. Gulf Coast Field Station.
For primary bibliographic entry see Field 5B.
W80-02967

EFFECTS OF TEMPERATURE ON THE GROWTH AND SURVIVAL OF THE EUROPEAN EEL, ANGUILLA ANGUILLA L.,
Central Electricity Generating Board, Ratcliffe-on-Soar (England). Freshwater Biology Unit.
For primary bibliographic entry see Field 5A.
W80-02968

TRACE METALS IN FUCOID ALGAE AND PURPLE SEA URCHINS NEAR A HIGH ARCTIC LEAD/ZINC ORE DEPOSIT,
British Columbia Research Council, Vancouver.
For primary bibliographic entry see Field 5B.
W80-02969

LABORATORY EXPERIMENTS ON THE EFFECTS OF CRUDE OIL ON THE RED SEA CORAL STYLOPHORA PISTILLATA,
Tel Aviv Univ. (Israel). Dept. of Zoology.
B. Rinkevich, and Y. Loya.
Marine Pollution Bulletin, Vol 10, p 328-330, 1979. 2 Tab, 16 Ref.

Descriptors: *Oil, *Toxicity, *Coral, Mode of action, Reproduction, Animal physiology, Oil pollution, Oil spills, Mortality, Benthic fauna, Organic compounds, *Crude oil, *Tissue analysis.

Sub-lethal detrimental effects of Iranian crude oil were studied on the hermatypic coral Stylophora pistillata in a long term laboratory experiment. The experimental system consisted of four 1500 l. capacity tanks, two of which were periodically polluted. A significant decrease in the number of female gonads per polyp were recorded in 75% of the colonies in the polluted tanks. It is concluded that chronic-oil pollution damages the reproductive system of scleractinian corals. (Deal-EIS)
W80-02970

DDTS IN MARINE FISHES FOLLOWING TERMINATION OF DOMINANT CALIFORNIA INPUT: 1970-77,
California Univ., Los Angeles. Dept. of Environmental Science and Engineering.
For primary bibliographic entry see Field 5B.
W80-02971

TOXICITY OF SOLUBLE COPPER AND OTHER METAL IONS TO ELODEA CANADENIS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
For primary bibliographic entry see Field 5A.
W80-02980

Group 5C—Effects Of Pollution

DISTRIBUTION OF ESSENTIAL AND TOXIC METALS IN THE TERRESTRIAL GASTROPOD ARION ATER,
University Coll. of Wales, Aberystwyth. Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-02981

ORGANOCHLORINE PESTICIDES AND POLYCHLORINATED BIPHENYLS IN BIRD EGGS FROM THE FALKLAND ISLANDS AND NORTH GERMANY, (IN GERMAN),
Hamburg Univ. (Germany, F. R.). Zoologisches Inst.
For primary bibliographic entry see Field 5B.
W80-02982

DISTRIBUTION OF COBALT 60 IN A MOLLUSC, A CRUSTACEAN AND A FRESHWATER TELEOST: VARIATIONS AS A FUNCTION OF THE SOURCE OF POLLUTION AND DURING ELIMINATION,
CEA Centre d'Etudes Nucleaires de de Cadarache, Saint-Paul-les Durance (France). Dept. de Protection.
For primary bibliographic entry see Field 5A.
W80-02984

MECHANISM OF DDT RESISTANCE IN LARVAE OF THE MOSQUITO AEDES AEGYPTI L.; THE EFFECT OF DDT SELECTION,
Victoria Univ. of Manchester (England). Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W80-02985

THE GILL SIALIC ACID CONTENT AS AN INDEX OF ENVIRONMENTAL STRESS IN RAINBOW TROUT, SALMO GAIRDNERI, RICHARDSON,
Genova Univ. (Italy). Inst. of Zoology.
For primary bibliographic entry see Field 5A.
W80-02988

EFFECTS OF TEMPERATURE AND FOOD ON DEVELOPMENTAL TIMES AND GROWTH IN DAPHNIA OBTUSA KURZ AND SIMOCEPHALUS VETULUS (O. F. MULLER) (CRUSTACEA, CLADOCERA),
Istituto Italiano di Idrobiologia, Pallanza.
For primary bibliographic entry see Field 5A.
W80-02990

CHEMICAL COMPOSITION OF TAIWAN'S OYSTERS AND CLAMS,
Kaohsiung Inst. of Marine Technology (Taiwan).
For primary bibliographic entry see Field 5A.
W80-02992

THE CARBON BALANCE IN AN EXPERIMENT REGARDING THE BACTERIAL BIODEGRADATION OF A TOPPED CRUDE OIL (IN FRENCH),
Laboratoire de Cryptogamie du MNHN, Paris (France).
For primary bibliographic entry see Field 5B.
W80-02993

5D. Waste Treatment Processes

WATER REUSE AND RECYCLING VOLUME 2: EVALUATION OF TREATMENT TECHNOLOGY.
Culp/Wesner/Culp, El Dorado Hills, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-131469, Price codes: A99 in paper copy, A01 in microfiche. Office of Water Research and Technology Report No OWRT/RU-79/2 (1979). 714 p, 164 Fig, 181 Tab, 29 Ref, 5 Append. OWRT R-0087 (7803)(1).

Descriptors: *Water reuse, *Waste water treatment, *Recycling, Water conservation, Water costs, Water supply, Water utilization, Reclaimed water, Sewage treatment, Treatment facilities, Effluents, Cost-benefit analysis, Cost analysis, Industrial water.

Beneficial uses for reclaimed waste water and the treatments necessary to produce the needed effluent quality for these uses are examined. Treatment processes are evaluated by: (1) effectiveness of contaminant removal, (2) reliability and operability, (3) cost effectiveness, (4) energy requirements, and (5) sidestream and by-product impacts. The commonly accepted types of reclaimed waste water use are controlled or uncontrolled, direct or indirect, and recycled. If reuse is planned and intentional it is considered controlled. Indirect refers to the 'loss of identity' of a waste water discharge as it flows downstream. Recycled refers to internal reuse of water prior to discharge. Beneficial uses for waste water are identified and requirements for each category are estimated. Eleven basic levels of treatment to yield increasingly improved effluent qualities are identified. Effluent quality from the various treatment systems studied is compared to effluent quality requirements for beneficial uses. Using this comparison, beneficial uses and compatable treatment levels are identified. Graphs are presented evaluating the economic impact of increased levels of waste water treatment for reuse versus the cost of obtaining new water supplies. (Seigler-IPA)
W80-02711

THE INFLUENCE OF AN ANAEROBIC ZONE IN ACTIVATED SLUDGE SYSTEMS ON THE BACTERIAL POPULATION STRUCTURE,
Orange Free State Univ., Bloemfontein (South Africa). Inst. of Environmental Sciences.
D. F. Toerien, H. J. Van Vuuren, D. N. Sadie, and R. P. Tracey.
Water S. A., Vol 5, No 3, p 109-113, July 1979. 2 Fig, 4 Tab, 7 Ref.

Descriptors: *Waste water treatment, *Phosphates, *Nutrient removal, *Anaerobic conditions, Anaerobic bacteria, Aquatic microbiology, Sludge treatment, Activated sludge, Sewage treatment, Eutrophication, Water pollution treatment.

The enhancement of phosphate removal in activated sludge waste water treatment was examined. Progress in this area is important to the control of eutrophication of surface waters. Previous studies indicate that the addition of an anaerobic zone to activate sludge systems makes no difference in the quantity of phosphate removing bacteria in the sludge. Bacteria from activated sludge systems both with and without anaerobic zones were grouped according to selected phenotypic properties to determine whether or not phosphate accumulation is a property of a specific group of activated sludge bacteria. In all 72 bacterial cultures were analyzed and physiological and biochemical reactions were recorded as positive or negative using the API 20E system. The bacterial isolates fell into two main groups at a 50% similarity level. The grouping indicates that the presence or absence of an anaerobic zone does not lead to a selection of specific groups of bacteria. The bacteria were then grouped into clusters at the 82.5% similarity level. Here, signs of selective influences were detected. The occurrence of phosphate-accumulating isolates in the clusters and in the two main groups were determined to see if selection influences were important to phosphate-removal activity. Results show that selective influences do not affect the ratio (1/3) at which phosphate-accumulating organisms occur. (Seigler-IPA)
W80-02750

SIMULTANEOUS BIOLOGICAL NITROGEN AND PHOSPHATE REMOVAL FROM WASTEWATER IN A MODIFIED PHOSTRIP PROCESS,
Institute for Water Research Pretoria (South Africa).
A. R. McLaren.
Water S. A., Vol 5, No 3, p 144-151, July 1979. 3 Fig, 2 Tab, 18 Ref.

Descriptors: *Waste water treatment, *Phosphates, *Nutrient removal, *Nitrogen, Chemical oxygen demand, Aeration, Sludge treatment, Anaerobic conditions, Sewage treatment, Lime, Ammonia, Denitrification, Waste treatment, Phostrip process, Bardenpho process.

The successful simultaneous removal of nitrogen and phosphate from sewage effluent using a modified Phostrip process is reported. The Phostrip process, designed to remove phosphate during biological sewage treatment, uses an acid and/or anaerobic treatment of secondary sludge with a time treatment to precipitate out the phosphate. The modified process included a denitrification reactor, a main aeration stage (split into two separate consecutive basins), a clarifier, and a phosphate stripping stage. The unit was tested with sludge from a pilot plant and with settled sewage from the Daspoort, Pretoria, sewage treatment plant. A modified Bardenpho process was also tested with the sludge. With this process the two anaerobic reactors were placed ahead of the denitrification stage and the sludge stripper separator was removed. Both processes demonstrated good chemical oxygen demand removal. The modified Phostrip process produced a high degree of nitrogen removal using only influent sewage organics as hydrogen donors. Normal phosphate removal levels were not reduced. The Bardenpo process also produced excellent phosphate and nitrogen removal. The modified Phostrip process has potential for application where influent sewage composition is not favorable for pure biological phosphate removal. (Seigler-IPA)
W80-02754

PROCEEDINGS -- WATER REUSE SYMPOSIUM, MARCH 25-30, 1979, WASHINGTON, D.C. VOLUMES 1, 2, AND 3,
Available from American Water Works Association Research Foundation Denver, Colorado, $15.00/Set, 1979. 2391 p, 678 Fig, 369 Tab, 1140 Ref.

Descriptors: *Water reuse, *Waste water treatment, *Water conservation, Industrial water, Municipal water, Irrigation water, Return flow, Reasonable use, Agriculture, Environmental effects, Water utilization, Drainage water, Reclamation, Salvage value.

The 155 papers presented at the symposium are given. The symposium's central theme was 'water reuse -- from research to application' in the areas of agricultural, municipal, and industrial waste waters. Poster presentations were used and photographs of some posters are included. The papers as a whole show that interest in waste water reuse is global, that recycling is applicable to a broad range of functions, that water reuse is situation-dependent, and reuse is an important conservation measure. The papers are grouped into the categories of: (1) water reuse policy, implementation and potential, (2) water supply augmentation, (3) industrial recycling and reuse, (4) planning for reuse, (5) aquiculture, wetlands, and eco-systems, (6) international developments, (7) institutional factors, (8) treatment R and D/operations, (9) municipal reuse, (10) modeling, monitoring and instrumentation, (11) agricultural reuse, and (12) health and quality considerations. (Seigler-IPA)
W80-02760

AQUACULTURAL APPROACHES TO WASTEWATER NUTRIENT RECYCLING,
California Univ., Los Angeles. Dept. of Biology.
M. S. Gordon, and D. J. Chapman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-135130, Price codes: A05 in paper copy, A01 in microfiche. Technical Completion Report, July 1979. 48 p, 2 Fig, 22 Tab, 37 Ref. OWRT C-7052 (6206)(1) 14-34-0001-6206.

Descriptors: *Aquiculture, *Waste water treatment, *Algae, *Scenedesmus, *Daphnia, Crustaceans, Minnows, Agriculture, Biomass, Food chains, Carnivores, Herbivores, Nutrients, Productivity, Fertilization, Nutrient requirements.

Five years of laboratory scale studies were conducted to access the potential of waste water aqui-

culture as a means of (1) developing a basis for a freshwater aquiculture industry in the U.S., (2) producing salable foods or other commodities to improve waste treatment plant economics, (3) reducing agricultural energy costs by eliminating fertilization needs, and (4) improving the quality of waste treatment plant discharges. Sequential monocultures of waste water based food chains were investigated using unicellular green algae, herbivorous cladoceran crustaceans, and carnivorous and herbivorous teleost fishes. All waste water used for the studies was fully secondarily treated, chlorinated, and dechlorinated. The general approach was for low technology, simple procedures and equipment, and minimal operator skills requirements. Results of the studies are presented in detail, however, materials and methods used are published elsewhere. Study results show that the use of artificial food chains for tertiary waste water treatment is feasible for the reduction of nutrient loading and for the production of valuable protein sources. The algal culture studied, Scenedesmus, was found to be highly sensitive to temperature, light, pH, and iron levels. The best group of cladoceran species tested for growth on Scenedesmus was Daphnia magna giving a food conversion efficiency of greater than 10%. Minnows and shiners can be grown of either live or dried daphnids. (Seigler-IPA)
W80-02764

INSTITUTIONAL STRUCTURES AFFECTING ON-SITE WASTE DISPOSAL IN MAINE,
Maine Univ. at Orono. Life Sciences and Agriculture Experiment Station.
G. K. White, and J. D. Davis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-134687, Price codes: A04 in paper copy, A01 in microfiche. Technical Completion Report, Bulletin 761, September 1979. 48 p, 1 Fig, 3 Tab, 54 Ref. OWRT-A-046-ME(2).

Descriptors: *Maine, *Sewage disposal, *Regulation, *Legal aspects, Monitoring, Zoning, Standards, Land use, Sewerage, Sewage treatment, Waste water disposal, Environmental sanitation, Septic tanks, Waste treatment, Plumbing.

Three main State-level agencies involved in sewage disposal regulations in Maine are the Land Use Regulation Commission; the Department of Environmental Protection (DEP); and the Department of Human Services, Division of Health Engineering. The Land Use Regulation Commission grants permits for the development of private sewage disposal systems to applicants who meet the requirements of the Maine Plumbing Code and who: (1) plan to build on tested suitable soil, (2) have the necessary financial ability, (3) have the necessary technical ability, and (4) plan to meet the minimum lot size standards. The DEP enforces water pollution control laws, licenses and monitors effluents, and assists in disposal planning. The Division of Health Engineering is the major agency regulating sub-surface disposal. Advances and newly developed techniques have brought about many regulatory changes with older less comprehensive test methods being replaced by newer more rigorous investigations and site evaluations. Some local communities have even adopted standards more stringent that the State's. The Maine Plumbing Code is used as a regulatory device for land development. The Code was adopted in 1926 and has been revised frequently due to experience with technical problems and various legislative moves to handle these problems. Some areas of the Code are discussed in detail along with various disposal alternatives that are permitted. A brief national sewage disposal perspective is also presented. (Seigler-IPA)
W80-02765

TREATMENT OF DOMESTIC WASTES IN LAKESHORE DEVELOPMENTS,
Wisconsin Univ., Madison.
R. J. Otis.
In: Lake Restoration, Report No EPA 440/5-79-001, p 95-102, 1979. 8 Fig, 40 Ref.

Descriptors: *Septic tanks, *Waste water disposal, *Eutrophication, Lakes, Lake shores, Sewage disposal, Filtrations, Domestic wastes, Water pollution sources, Evapotranspiration, Soil water movement, Soil types, Nutrients.

Septic tanks are the most common method used for the disposal of sewage from private homes surrounding lakes. On suitable soils with a well designed, installed, and maintained system, septic tanks are an effective and cost-efficient sewage disposal method. However, as much as 68% of U.S. land is unsuitable for septic tanks and even on suitable soils they are often poorly designed, installed, and maintained. Along lakeshores this results in nutrient loading of the lake. The most often suggested solution to this problem is the installation of a conventional gravity sewer system. However, for lakeshore communities, this is often impractical due to the small number of people and the high costs involved. Onsite systems are the most effective alternative to conventional systems. Onsite systems include well designed and maintained septic tanks, mound systems, sand filters, evapotranspiration beds, wastewater modification, and grey water management. Good management and maintenance are the keys to success of onsite disposal systems. A public management authority with trained personnel to properly operate and maintain systems would be a valuable and cost efficient method of solving lakeshore sewage problems. (See also W80-02773) (Seigler-IPA)
W80-02791

PROGRESS IN WASTEWATER DISINFECTION TECHNOLOGY, PROCEEDINGS OF THE NATIONAL SYMPOSIUM, CINCINNATI, OH, SEPTEMBER 18-20, 1978,
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 338, Price codes: A13 in paper copy, A01 in microfiche. Report No EPA-600/9-79-018, June 1979, Edited by Venosa, A.D., 294 p, 2 Append.

Descriptors: *Disinfection, *Waste water treatment, *Ozone, *Chlorination, *Ultraviolet radiation, Sewage effluents, Water sampling, Coliforms, Analytical techniques, Organic compounds, Pilot plants, Waste water(Pollution), Chlorine, Efficiencies, Viruses, Aquatic microorganisms, E. coli, Environmental effects.

Twenty papers on the latest in waste water disinfection were presented at the symposium by scientists, consulting engineers, municipal design engineers, and various technical government officials. Following the presentation of most of the papers, a five minute question and answer session was held. Text of these sessions are provided at the end of the papers. The symposium had six major topic sessions: (1) chlorination/dechlorination, (2) chlorine dioxide, (3) ultraviolet light, (4) ozone, (5) viruses and organics, and (6) planning and implementation. Following all but the last session, a 30 to 75 minute roundtable discussion was held and these discussions are included in the proceedings. Overall symposium conclusions are: (1) rapid progress is being made in waste water disinfection; (2) chlorine usage savings are possible with optimized mixing; (3) sulfur dioxide dechlorination is cost effective, but not with actived carbon or holding lazons; (4) a bubble diffuser contractor is best for disinfection of well oxidized, filtered secondary effluent; (5) ozone disinfection is twice as costly as chlorine; (6) ultraviolet light disinfection is promising; (7) interesting results are being found on nonvolatile organic by-product formation by chlorine, ozone, and ultraviolet light. (See W80-02813 thru 02831) (Seigler-IPA,
W80-02812

FIELD STUDIES IN OPTIMIZATION OF WASTEWATER CHLORINATION,
California Dept. of Health Services, Berkley.
E. Sepp, P. Bao, and A. Custodio.
In: Progress in Wastewater Disinfection Technology Report No EPA-600/9-79-018, p 7-11, 1979. 6 Fig, 3 Ref.

Descriptors: *Waste water treatment, *Chlorination, *Coliforms, *Sewage bacteria, California, Domestic wastes, Sewage, Pilot plants, Industrial wastes, Sludge, Bacteria, Chlorine, Nitrification, Disinfection, Optimization.

Three chlorination studies conducted by the California Department of Health Services were designed to reduce chlorine induced toxicity and to produce a savings in chlorine use. Three mobile units were used in the studies: a chlorination pilot plant, a fish bioassay laboratory, and a public health laboratory. The pilot plant features rapid initial mixing, automatic control of chlorine dosage by residual control, and plug flow contact chambers to provide a variety of contact times. The first study was at a San Leando activated sludge plant where plant flow was almost 50% industrial wastes. Many problems occurred and bacterial results from the pilot were not noticeably better than those from the full scale plant. An activated sludge plant at San Pablo which uses roughing trickling filter and complete nitrification was used for the second study. Here, the pilot plant produced the same level of disinfection with a lower chlorine dosage. The third study used the Pinole activated sludge plant which treats entirely domestic wastes. Here, the pilot plant again required a lower chlorine dosage and produced fewer residuals. Coliform survival data are plotted for the pilot plant and the full scale plants in all three studies. Text of a brief discussion on the information presented is included. (See also W80-02812) (Seigler - IPA)
W80-02813

COMPARISON OF ACUTE TOXICITY OF CHLORINATED EFFLUENTS FROM OPTIMIZED AND EXISTING FACILITIES,
California State Dept. of Fish and Game, Rancho Cordova. Pollution Control Lab.
B. J. Finlayson, and R. J. Hansen.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 12-23, 1979. 9 Fig, 3 Tab, 20 Ref.

Descriptors: *Toxicity, *Chlorination, *Waste water treatment, *Pilot plants, California, Water pollution effects, Disinfection, Nitrification, Shiners, Minnows, Chlorine, Effluents, Optimization.

The California Department of Fish and Game is using a specially designed mobile laboratory to monitor the toxicity of chlorinated waste water from existing treatment plants and from a chlorination optimizing pilot plant. Existing waste water treatment plants involved are the San Pablo and Pinole plants. The mobile laboratory is housed in an 8 by 2.7 m trailer. Total laboratory cost is approximately $30,000. The mobil unit has three areas, a water control room, a bioassay room, and a laboratory. Standard 96-h continual-flow bioassay methods are used to test toxicity on fathead minnows and golden shiners. Comparison of toxicity results from the existing plants and the pilot plant shows that in all cases residuals from the pilot plant were lower. Therefore, it appears that the pilot plant does use chlorine more efficiently and reduces effluent toxicity. Fathead minnows were found to be more sensitive to chlorine than shiners. Fathead minnows are also more sensitive to nitrified and ammoniated effluents. Nitrification of waste waters before chlorination does reduce the toxicity of the chlorine residuals. Text of a brief discussion on the paper is also presented. (See also W80-02812) (Seigler - IPA)
W80-02814

DESIGN OF A CHLORINATION SYSTEM FOR LAGOON DISINFECTION,
Utah Water Research Lab., Logan.
B. A. Johnson, J. H. Reynolds, J. L. Wight, and E. J. Middlebrooks.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 24-35, 1979. 14 Fig, 1 Tab, 19 Ref.

Descriptors: *Chlorination, *Waste water treatment, *Mathematical models, *Sewage lagoons, Bacteria, Coliforms, Effluents, Disinfection, Sewage bacteria, Chlorine, Dissolved oxygen, Algae, Utah, Biochemical oxygen demand.

A mathematical model to represent the effects of chlorination of lagoon effluents and to predict the necessary chlorine dosages was developed from data collected during a 12 month study at a field scale waste stabilization lagoon facility. The test

facility at Logan, Utah, has four chlorination systems. Chlorinated samples were tested for total and fecal coliforms, ammonia, biochemical oxygen demand, dissolved oxygen, sulfide, suspended solids, pH, temperature, turbidity, and other water quality factors. Total coliform removal efficiency is plotted as a function of total chlorine residual at various contact times. Both filtered and unfiltered lagoon effluents were studied. Results show that increasing total chlorine residual produces increased total and fecal coliform reduction for both filtered and unfiltered effluents. The mathematical model predicts chlorine dose, contact time, and chlorine residual for adequate disinfection. Design curves for selecting chlorine doses and contact times for desired disinfection levels were constructed by applying the model. The equations used to develop the design curves are provided. Two examples of curve application are presented. Text of a brief discussion on the paper is also presented. (See also W80-02812) (Seigler - IPA)
W80-02815

DECHLORINATION OF WASTEWATER: STATE-OF-THE-ART FIELD SURVEY AND PILOT PLANT STUDIES,
Los Angeles County Sanitation Districts, CA.
H. B. Gan, C. Chen, and A. D. Venosa.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 36-48, 1979. 9 Fig, 11 Tab, 2 Ref.

Descriptors: *Chlorination, *Waste water treatment, *Sulfur compounds, Pilot plants, Effluents, Sewage bacteria, Chlorine, California, Ponds, Activated carbon, Environmental effects, Waste water(Pollution), Coliforms, Sludge.

A field survey of dechlorination installations in California was conducted to access their effectiveness and reliability. Survey data were collected by questionnaires and on-site visits. Results show that sulfur dioxide is the most commonly used dechlorinating agent due to low cost and ease of application. Most dechlorination facilities were installed after January 1976 at secondary treatment plants due to California's recent strict waste water treatment requirements. Approximately 94% of the facilities operate continuously 24 hours a day. Other survey results and percentages are provided in tabular form. Site visits were used to observe various sulfur dioxide feed methods. Pilot plant studies were also conducted to determine bacteriological, physical, and chemical degradation effects after dechlorination. In the pilot plants, three dechlorination methods were studied, sulfur dioxide, granular activated carbon, and holding ponds. As in the field study, sulfur dioxide was the most commonly used method. Comparative cost estimates are given for the three methods. Text of a brief discussion on the paper is also provided. (See also W80-02812) (Seigler - IPA)
W80-02816

EFFECTIVENESS OF CHLORINE DIOXIDE AS A WASTEWATER DISINFECTANT,
Stanford Univ., CA. Dept. of Civil Engineering.
J. D. Berg, E. M. Aieta, P. V. Roberts, and R. C. Cooper.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 61-71, 1979. 6 Fig, 11 Tab, 6 Ref.

Descriptors: *Waste water treatment, *Chlorination, *Disinfection, *Chlorine, Sewage bacteria, Viruses, Aquatic microorganisms, Coliforms, E. coli, Efficiencies, Effluents, Sewage effluents, Waste water(Pollution).

The use of chlorine dioxide as an alternative to chlorine for municipal waste water disinfection is evaluated. Chlorine dioxide is a strong oxidant over a broad pH range, provides a measurable residue, does not react with ammonia, and does not yield trihalomethanes. Membrane filter (MF) and most probable number (MPN) methods for counting bacteria were applied and a computerized comparison was performed. Results show that MPN and MF methods have equivalent accuracy when applied to fecal coliform counts, MF is more 'precise' than MPN, and MF is a more appropriate estimator of realistic conditions. Various experiments were then conducted to determine the factors effecting chlorine dioxide bactericidal efficiency. Results show: (1) suspended solids reduce bactericidal efficiency, (2) pure batch-grown E. coli cultures are more susceptible than native population, and (3) chlorine dioxide and chlorine are nearly equally effective with pure or native cultures of E. coli. Finally, tests were conducted on the virucidal effectiveness of chlorine dioxide. Test results indicate than: (1) chlorine and chlorine dioxide at 5 mg/1 in secondary effluent produce the same responses in Poliovirus I and coliphage, (2) chlorine dioxide at all dosages is more effective than chlorine at the highest dosage, and (3) chlorine dioxide is more effective as a virucide than as a bactericide. (See also W80-02812) (Seigler - IPA)
W80-02817

CHLORINE DIOXIDE: ANALYTICAL MEASUREMENT AND PILOT PLANT EVALUATION,
Stanford Univ., CA. Dept. of Environmental Engineering.
E. M. Aieta, B. Chow, and P. V. Roberts.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 72-85, 1979. 7 Fig, 13 Tab, 14 Ref.

Descriptors: *Waste water treatment, *Chlorination, *Disinfection, *Chlorine, Sewage bacteria, Aquatic microorganisms, Coliforms, Efficiencies, Effluents, Waste water(Pollution), Analytical techniques, Volumetric analysis, Pilot plants, Statistical methods.

The use of chlorine dioxide as an alternative to chlorine for wastewater disinfection was investigated. Analytical techniques used in the investigation are described including stock generation techniques, stock measurement techniques, and residual measurement techniques for chlorine and chlorine dioxide. Residual measurement techniques used include ferrous titrimetric determination and amperometric titration. The bactericidal effectiveness of both disinfectants was tested on secondary effluent from the Palo Alto Water Pollution Control Plant. Total coliform bacteria were analyzed by membrane filter technique. Statistical analyses were done to investigate any biases in data due to experiment order or sampling technique. Results indicate: (1) both disinfectants give decreased survival ratios with increased dose or contact time, (2) both disinfectants give essentially the same survival ratios on a mass dose with a 30 minute contact time, (3) for short contact times chlorine dioxide is more effective, and (4) chlorine dioxide provides the same effectiveness as chlorine but produces lower residual concentrations. A disinfection model was designed for both chlorine and chlorine dioxide to allow application of study results to actual waste water treatment situations. Pilot plant studies will be used to verify the model. Text of a brief discussion on the paper is provided. (See also W80-02812) (Seigler - IPA)
W80-02818

EFFECT OF PARTICULATES ON INACTIVATION OF ENTEROVIRUSES IN WATER BY CHLORINE DIOXIDE,
Cincinnati Univ., OH. Dept. of Civil and Environmental Engineering.
F. A. Brigano, P. V. Scarpino, S. Cronier, and M. L. Zink.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 86-94, 1979. 11 Fig, 1 Tab, 33 Ref.

Descriptors: *Waste water treatment, *Disinfection, *Viruses, *Chlorine, Chlorination, Turbidity, Bentonite, Coliforms, Aquatic microorganisms, Effluents, Efficiencies, Analytical techniques, Waste water(Pollution).

The ability of suspended matter (turbidity) and viral aggregates to decrease the effectiveness of chlorine dioxide as a disinfectant for waste water treatment is examined. The importance of disinfectant residuals is also considered due to the ability of coliforms and fecal coliforms to regrow in chlorinated waste water effluents. A laboratory experiment with poliovirus 1 is described including chlorine dioxide measurement, virus quantitation and characterization, poliovirus preparation, bentonite preparation, poliovirus-bentonite complex preparation, cell associated-poliovirus 1 preparation, experimental procedures, and poliovirus assay procedure. Results show that at 5C and a pH of 7, poliovirus aggregates took 2.7 times longer to inactivate than did single state viruses with a chlorine dioxide disinfectant. Bentonite adsorbed-poliovirus 1 single were used to test inorganic turbidity effects. Results show that increasing temperature increases disinfection efficency for unassociated poliovirus singles, however, for bentonite adsorbed-poliovirus 1 single, temperature increases caused disinfection efficiency decreases. Overall, temperature and turbidity were found to affect disinfection rates with bentonite-adsorbed poliovirus while no effect was found in the turbidity levels of cellular-associated virus. Text of a brief discussion on the paper is included. (See also W80-02812) (Seigler-IPA)
W80-02819

UTILITY OF UV 'DISINFECTION' OF SECONDARY EFFLUENT,
Texas A and M Univ., College Station. Dept. of Environmental Engineering.
H. W. Wolf, A. C. Petrasek, and S. E. Esmond.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 100-107, 1979. 12 Fig, 1 Tab, 7 Ref.

Descriptors: *Waste water treatment, *Ultraviolet radiation, *Disinfection, Coliforms, Turbidity, Aquatic microorganisms, Effluents, Efficiencies, Viruses, Suspended solids, Chlorination, Biochemical oxygen demand.

A 16-month project was conducted at the Dallas Water Reclamation Research Center to investigate the adequacy of ultraviolet (UV) light as a secondary waste water disinfectant. A fecal coliform content of 200/100 ml was considered adequate. Two UV generating units were used, a Kelly-Purdy unit and a unit made by Ultraviolet Purification Systems, Inc. Experiments were run on various stages and types of effluent including three virus seeding experiments with poliovirus 1 and F2 coliphage. Stringent sampling and analysis was conducted for many variables including total suspended solids, turbidity, and transmissability. Five runs were made with the Kelly-Purdy unit, however, due to its design there were problems with the accumulation of solids in the tray. Eight runs were then made with the Ultraviolet Purification Systems unit. Data plots are provided for the results which indicate that UV irradiation is a viable alternative disinfection procedure for the criterion of 200 fecal coliforms/100 ml. However, UV effectiveness varies with effluent quality so treatments must be designed to accomodate effluent variations. Text of a brief discussion on the paper is included. (See also W80-02812) (Seigler-IPA)
W80-02820

UV DISINFECTION OF SECONDARY EFFLUENT,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
J. D. Johnson, K. Aldrich, D. E. Francisco, T. Wolff, and M. Elliott.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 108-116, 1979. 6 Fig, 2 Tab, 3 Ref.

Descriptors: *Waste water treatment, *Ultraviolet radiation, *Disinfection, Coliforms, North Carolina, Aquatic microorganisms, Effluents, Efficiencies, Biochemical oxygen demand, Turbidity, Suspended solids, Water temperature, Potassium.

Various aspects of waste water disinfection by ultraviolet light (UV) were investigated including the use of chemical actinometry to measure UV dosages, the occurrence of photoreactivation in UV treated samples exposed to sunlight, and the effects of water quality parameters on UV disinfection of filtered and unfiltered secondary effluent. UV disinfection is being conducted at a pilot plant in Durham, North Carolina, with two commercial-

ly available UV sterilization units. Lack of consistency in UV dosage determination is a problem. In the investigation, potassium ferrioxalate actinometry was used to measure dosage for disinfection of pure cultures of E. coli in tap water. Actinometry dosages were found to be directly related to the average light penetrated fluid depth and to the average intensity of multiple lamp units. Photoreactivation experiments showed a 1.4 log recovery in total coliforms at 25C. Lower recoveries were found at lower temperatures. Water quality parameter effects are still being studied, but a major influencing parameter appears to be the non-ideal flow patterns of the two units being used. More data analysis is needed to clarify the effects of other parameters. Text of a brief discussion on the paper is included. (See also W80-02812) (Seigler-IPA)
W80-02821

FULL SCALE EVALUATION OF ULTRAVIOLET DISINFECTION OF A SECONDARY EFFLUENT,
Hydroscience, Inc., Westwood, NJ.
O. K. Scheible, G. Binkowski, and T. J. Mulligan.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 117-125, 1979. 12 Fig.

Descriptors: *Waste water treatment, *Ultraviolet radiation, *Disinfection, Coliforms, New Jersey, Effluents, Efficiencies, Chlorination, Light intensity, Photoactivation, Comparative costs, Water sampling, Aquatic bacteria, Thin films.

A thin film ultraviolet (U.V.) disinfection system was installed and evaluated at the Northwest Bergen County Water Pollution Control Plant in Waldwick, New Jersey. The U.V. disinfection unit was installed in an inactive chlorine contact chamber. The unit has 400 germicidal lamps with an output of 30W for each lamp. During June through August, 1978, two randomized sampling series were conducted. The first evaluated unit effectiveness at two flow rates and flow voltages. The second evaluated unit effectiveness at one flow rate with variable lamp operations and voltages. Results indicate that the system did provide effective bactericidal treatment for the water quality conditions at the plant. Costs for this particular system, excluding support structures and ancillary equipment, are estimated to be 0.9 to 1.4 cents per 1,000 gal. Photoreactivation studies were also conducted and significant increases in fecal coliform levels were noted after the exposure of U.V. irradiated samples to visible light. Plots of tests results are provided along with the text of a brief discussion held after the paper was presented. (See also W80-02812) (Seigler-IPA)
W80-02822

COMPARISON OF MPN AND MF TECHNIQUES OF ENUMERATING COLIFORM BACTERIA IN OZONATED WASTEWATER EFFLUENT,
Municipal Environmental Research Lab., Cincinnati, OH.
M. C. Meckes, and A. D. Venosa.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 136-143, 1979. 1 Fig, 8 Tab, 12 Ref.

Descriptors: *Ozone, *Waste water treatment, *Disinfection, Probability, Statistical methods, Coliforms, Efficiencies, Chlorination, Effluents, Sewage bacteria, Sewage effluents, Bacteria, Chlorine, Treatment, Water purification.

Two fecal coliform counting techniques, Most Probable Number (MPN) and Membrane Filter (MF) were compared for ozonated secondary waste water effluent. The code of Federal Regulations has established the MPN method as the method of preference for enforcement situations involving chlorination. However, ozone is being increasingly used for waste water disinfection, and the MF method is rapid, simple, and more economical than the MPN method. The two techniques were compared at different applied ozone levels according to Standard Methods. Six repetitions of each ozone dosage were conducted and separate analyses of variance of the data for total and fecal coliforms were performed. For each analysis, three main effects and four interactive effects were considered. Results indicate no significant difference between the MF and the MPN techniques for counting total and fecal coliforms in secondary ozonated waste water effluent. However, ozone dosage did have a significant effect on the coliform numbers and coliform densities did vary for repetitions. It appears that either technique is an effective means of counting coliforms in ozonated effluents, however, due to the Code of Federal Regulations, approval for the use of the MF technique is still required. Text of a brief discussion on the paper is included. (See also W80-02812) (Seigler-IPA)
W80-02823

COMPARATIVE EFFICIENCIES OF OZONE UTILIZATION AND MICROORGANISM REDUCTION IN DIFFERENT OZONE CONTACTORS,
Municipal Environmental Research Lab., Cincinnati, OH. Wastewater Research Lab.
A. D. Venosa, M. C. Meckes, E. J. Optaken, and J. W. Evans.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 144-161, 1979. 18 Fig, 18 Tab, 8 Ref.

Descriptors: *Ozone, *Waste water treatment, *Disinfection, *Coliforms, Ohio, Effluents, Efficiencies, Water sampling, Statistical methods, Water purification, Optimization, Chemical oxygen demand, Ammonia, Turbidity, Water temperature.

Three ozone contactors were compared on the basis of log total and fecal coliform reductions. The contactors were operated in parallel on the same secondary waste water effluent under controlled conditions. The secondary effluent used came from the Robert A. Taft Laboratory, Cincinnati, Ohio, a conventional activated sludge plant. Ozone for disinfection was generated in a plate-type corona discharge ozonator and was then fed to the contactors. After treatment, grab samples were taken and analyzed for total and soluble chemical oxygen demand, organic carbon, Kjeldahl nitrogen, ammonia-nitrogen, nitrite-nitrogen, suspended solids, turbidity, temperature, and pH. Bacteriological analysis samples were assayed for total and fecal coliforms by Standard Membrane Filtration. The contactors tested were a packed column ozone contactor, a pressure injector contactor, and a bubble diffuser ozone contactor. The effect of increasing the carrier gas flow rate/liquid flow rate ratio at a constant concentration of ozone in the carrier gas was tested. Here, overall ozone utilization was highest in the bubble diffuser followed by the packed column. Also tested was the effect of increasing the oxygen in the carrier gas at a constant carrier gas flow/rate liquid flow rate ratio. For these conditions, ozone utilization was again highest in the diffuser. In general, a highly significant log-log correlation was found beozone utilization and coliform reduction with the bubble diffuser best meeting all effluent limitations. (See also W80-02812) (Seigler-IPA)
W80-02824

ECONOMIC EVALUATION OF OZONE CONTACTORS,
Municipal Environmental Research Lab., Cincinnati, OH.
E. J. Opatken.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 162-173, 1979. 1 Fig, 18 Tab, 1 Ref.

Descriptors: *Ozone, *Waste water treatment, *Disinfection, *Cost analysis, Evaluation, Economic efficiency, Efficiencies, Chlorination, Water purification, Pilot plants, Electric power costs, Interest rates, Operating costs, Maintenance costs.

Three ozone contactors, a packed column (PC), a positive pressure injector (PPI), and a bubble diffuser were economically evaluated in parallel waste water disinfection. The bubble diffuser was tested at three different concentrations, 5, 10, and 15 mg/l. Summary cost data and detailed cost sheets were developed from pilot plant results. Ozone cost sheets including operating and overhead cost are presented for the PC, the PPI, and the bubble diffuser at all three concentrations. Significant results are: (1) the bubble diffuser at 10 mg/l had a decided edge over the other concentrations and contactors; (2) the PC appears to be the second best contactor due to an ozone cost advantage; and (3) although ozone is more expensive than chlorine, less ozone is needed for disinfection. Disinfection cost sheets are also presented again showing the bubble diffuser at 10 mg/l to be the most economical. Overall results show the bubble diffuser at 10 mg/l to have the lowest capital investment requirement of $266,000 and the lowest disinfection cost of 11 cents/M gal. (See also W80-02812) (Seigler-IPA)
W80-02825

FIELD SCALE EVALUATION OF WASTEWATER DISINFECTION BY OZONE GENERATED FROM AIR,
M and I, Inc., Fort Collins, CO.
K. L. Rakness, and B. A. Hegg.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 174-197, 1979. 10 Fig, 10 Tab, 2 Ref.

Descriptors: *Ozone, *Waste water treatment, *Coliforms, *Disinfection, Generators, Effluents, Sewage bacteria, Colorado, Waste water(Pollution), Efficiencies, Sewage effluents, Dew point, Air temperature, Electric power demand.

The operation of the ozone waste water disinfection system at the upper Thompson Sanitation districts advanced waste water treatment facility is discussed. The facility in operation since 1976, provides waste water treatment for Estes Park, Colorado. The ozone treatment process utilizes two air-fed ozone generators and a contact basin. To assess the operation of the system, data were collected for chemical and microbiological conditions, ozone in air concentrations, ozone in water concentrations, electrical power consumption, and other parameters. Ozone generation data show that the air pretreatment system performed well, however, high dew points have caused malfunctions and generator damage. An increase in dew point causes decreased ozone generation. The installation of a high dew point alarm is being considered to prevent future problems. Ozone system power requirements are running 30% greater than expected due to lower than design ozone production rates. Power consumption increases dramatically at low ozone production requirements. To be more energy efficient, ozone units must be built with more production level flexibility. Since the original construction of the ozone contacting system several improvements have been made including a contact basin cover, basin exhaust changes, baffle and scum skimmer changes, ozone piping and diffusion replacement, and currently, the construction of an ozone destruct system. When the system is performing well and has operated for several days disinfection is good, however, disinfection is poor during sporadic system operation. (See also W80-02812) (Seigler-IPA)
W80-02826

FIELD-SCALE EVALUATION OF WASTEWATER DISINFECTION BY OZONE GENERATED FROM OXYGEN,
Engineering-Science, Inc., Cleveland, OH.
J. S. Jain, N. L. Presecan, and M. Fitas.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 198-209, 1979. 9 Fig, 5 Tab.

Descriptors: *Ozone, *Wastewater treatment, *Disinfection, *Generators, Coliforms, Effluents, Sewage bacteria, Ohio, Waste water(Pollution), Efficiencies, Sewage effluents, Dew point, Electric power demand, Oxygen.

The Meander Ozonation System at the regional Meander Advanced Wastewater Treatment Facility in Trumball County, Ohio, was evaluated through a U.S. Environmental Protection Agency

funded R and D Study. It is the first U.S. facility using ozone produced from oxygen recycled from the contactor. The ozonators are designed to produce 180 kg/d ozone providing an ozone dosage of 6 mg/l. However, many problems have occurred during installation resulting in a late start-up and unreliable performance. Drying equipment problems have existed since installation including leaks in the refrigeration system, moisture in the drying bed, drying media insufficiency, and after-filter clogging. In the contacting tank, leaks have occurred in the ozone carrying pipes, the pressure/vacuum relief valves have occasionally opened, and gaskets on manholes and hatches have developed leaks. Control problems have occurred with ozone gas flow and production, with the Dasibi ozone meter, with the Delta Scientific dissolved ozone meter, and with the lower explosion limit monitor. It has also been necessary to replace many of the original plastic pipes with copper and stainless steel pipes. Due to all of these problems, only limited operating data have been collected, however, tables are presented for disinfection efficiency, water quality, and ozone generation efficiency. (See also W80-02812) (Seigler-IPA)
W80-02827

VIRUS INACTIVATION IN WASTEWATER EFFLUENTS BY CHLORINE, OZONE, AND ULTRAVIOLET LIGHT,
Carborundum Co., Niagara Falls, NY.
R. A. Fluegge, T. G. Metcalf, and C. Wallis.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 223-232, 1979. 18 Fig, 2 Tab, 3 Ref.

Descriptors: *Waste water treatment, *Disinfection, *Viruses, Coliforms, Chlorination, Ozone, Chlorine, Ultraviolet radiation, Efficiencies, Sewage effluents, Sewage bacteria, Turbidity, Waste water(Pollution), Pilot plants.

The viral inactivation efficiencies of five waste water treatment plants are compared. The plants and their inactivation methods are: (1) the Northwest Bergen County Wastewater Treatment Plant, Waldwick, New Jersey, ultraviolet irradiation; (2) the Estes Park Wastewater Treatment Plant, Estes Park, Colorado, ozone; (3) the Muddy Creek Sewage Works, Cincinnati, Ohio, chlorine; (4) the Marlborough Easterly Wastewater Treatment Plant, Marlborough, Massachusetts, chlorine; and (5) the R. A. Taft Laboratory pilot plant, ozone. A self-contained mobile laboratory with Aquella Virus Concentrators was used to sample the effluent at each site. Samples were analyzed for virus concentration and identification. No major seasonal variations in virus concentrations were found, however, a diurnal variation was found at the Muddy Creek Plant. No correlation was found between any of the standard waste water quality parameters and virus concentrations. Ten different virus types were identified: polioviruses 1, 2, and 3 and Coxaskie, A9, B1, B2, B3, B4, B5, and B6. Overall virus isolation rates and concentrations were significantly reduced by all three disinfection methods. (See also W80-02812) (Seigler-IPA)
W80-02828

EFFECTS OF CHLORINE, OZONE, AND ULTRAVIOLET LIGHT ON NONVOLATILE ORGANICS IN WASTEWATER EFFLUENTS,
Oak Ridge National Lab., TN.
R. L. Jolley, N. E. Lee, W. W. Pitt, M. S. Denton, and J. E. Thompson.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 233-245, 1979. 14 Fig, 5 Tab, 14 Ref.

Descriptors: *Waste water treatment, *Chlorination, *Ozone, *Disinfection, *Ultraviolet radiation, Sewage effluents, Analytical techniques, Chromatography, Chemical analysis, Spectrometers, Mass spectrometry, Chlorine, Coliforms, Organic compounds.

Effluent samples of waste water disinfection by chlorine, ozone, and ultraviolet (UV) light were analyzed to gather data on the effect of the disinfectant agent on nonvolatile organic constituents in the water. Waste water samples from the Oak Ridge West Wastewater Treatment Plant were disinfected by the various agents and were than concentrated by low-temperature distillation and freeze drying. Constituents were separated and identified by chromatography, ultraviolet spectrometry, and mass spectrometry. Ozone disinfection results show that the most rapid destruction of UV-absorbing compounds occurs within the first 3.5 mg/l dosage of ozone. Oxidizable constituents showed some initial destruction that increased with increasing ozone dosage. Waste water disinfection by chlorination also showed much nonvolatile organic constituent destruction along with the production of other nonvolatile compounds. However, disinfection by UV-light irradiation apparently has little effect on nonvolatile chromatographic constituents. Chromatograms illustrating and comparing results for the three disinfection methods are presented. (See also W80-02812) (Seigler-IPA)
W80-02829

MUTAGENIC ACTIVITY OF NONVOLATILE ORGANICS DERIVED FROM TREATED AND UNTREATED WASTEWATER EFFLUENTS,
Oak Ridge National Lab., TN.
R. B. Cumming, L. R. Lewis, R. L. Jolley, and C. I. Mashni.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 246-252, 1979. 3 Fig, 3 Tab, 5 Ref.

Descriptors: *Waste water treatment, *Genetics, *Disinfection, *Chlorination, Ozone, Ultraviolet radiation, Chromatography, Salmonella, E. coli, Bacteria, Chlorine, Tennessee, Sewage effluents, Water sampling, Chromozones.

A strain of Escherichia coli, WP2, and four strains of Salmonella typhinurium were used to test the mutagenic effects of nonvolatile organics resulting from waste water disinfection. Samples were taken from seven waste water treatment plants both before and after the final disinfection treatment. Samples were then shipped to the Oak Ridge National Laboratory for analysis. Clear positive mutagenic results were observed for chlorinated samples from some plants while others showed only negative results. However, this does not mean that these negative result plants are not producing mutagens, rather it means possibly that current testing organisms and procedures do not detect them. Positive mutagenic samples were separated into subsamples by high pressure liquid chromatography. Data from two such separations are presented. Although the testing technology for mutagenicity in waste water effluents is imperfect, there is no doubt about the reality of the problem especially in chlorinated waste water. Due to this potentially serious health hazard, planning for future disinfection plants needs to consider this mutagenic effect. (See also W80-02812) (Seigler-IPA)
W80-02830

PLANNING DECISIONS IN SELECTING WASTEWATER EFFLUENT DISINFECTION FOR THE OLENTANGY ENVIRONMENTAL CONTROL CENTER,
Environmental Protection Agency, Chicago, IL. Region V.
C. F. Grissom.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 258-262, 1979. 1 Fig, 6 Ref.

Descriptors: *Waste water treatment, *Ozone, *Environmental effects, *Disinfection, Chlorination, Ultraviolet radiation, Sewage effluents, Ohio, Chlorine, Insects, Mollusks, Discharge(Water), Aquatic life, Water pollution effects, Olentangy River, Environmental impact statements.

The Environmental Protection Agency's (EPA) rationale for selecting ozonation as the disinfection method for the Olentangy Environmental Control Center, Delaware County, Ohio, is reviewed. EPA prepared an environmental impact statement for the project in 1975. The original proposed waste water treatment facility was a two-stage activated sludge plant, with tertiary sand filters, phosphorus removal, and chlorination. However, due to the high natural quality of the Olentangy Rivers, EPA concluded that the residual chlorine concentrations that would be released into the river would be extremely hazardous to the river's quality. The Olentangy River is a State Scenic River with good dissolved oxygen levels, a high diversity of aquatic insects, a variety of mollusks including four state endangered species, a wide biological diversity, and is one of the few remaining natural stream segments in central Ohio. Alternative disinfection agents considered were ozone, sulfur dioxide effluent dechlorination, bromine chlorine, and ultraviolet light. Ozone was selected because it is produced on site and does not have to be stored, it has been used for several years in drinking water with no observed toxic effects, and it does not increase instream levels of dissolved solids. While ozonation was more costly than chlorination in terms of monetary investment, it was less costly in terms of social and ecological factors. Text of a brief discussion on the paper is included. (See also W80-02812) (Seigler, IPA)
W80-02831

BIOLOGICAL TREATMENT OF FOOD PROCESSING WASTEWATER DESIGN AND OPERATIONS MANUAL.
Stanley Associates Engineering Ltd., Ottawa (Ontario).
Available from the Environmental Protection Service, Environment Canada, Ottawa, Ontario, Canada, K1A 1C8. Economic and Technical Review Report EPS 3-WP-79-7, October 1979, 216 p, 55 Fig, 41 Tab, 30 Ref, 2 App.

Descriptors: *Biological treatment, *Food processing industry, *Waste water treatment, Organic wastes, Aeration, Treatment facilities, Ponds, Lagoons, Filters, Activated sludge, Manuals, Design, Operations, Permits, Administrative agencies.

Recent environmental legislation has made it necessary, in many cases, for the food industry to treat its wastewater prior to discharge. Although most wastes from the food processing industry are amenable to biological treatment, the success of the operation has been hindered by seasonability of operation, climatic conditions, faulty design and inadequate operation, as well as poor in-plant controls. This manual presents information regarding the design and operational requirements of currently available technology. The manual is intended to provide useful information to the food processing industry in assessing its treatment needs. Twelve case histories are presented for plants processing fruits and vegetable, milk products, meat products, and beverages. Design and operational data for existing wastewater treatment systems are included in the case histories. (WATDOC)
W80-02837

TOXICITY OF EFFLUENTS FROM SULPHITE PULPING OPERATIONS PRACTICING RECOVERY AND BIOLOGICAL TREATMENT.
Beak Consultants Ltd., Mississauga (Ontario).
Available from Environmental Protection Service, Department of the Environment, Ottawa, Ontario, Canada, K1A 1C8. Economic and Technical Review Report EPS 3-WP-79-9, October 1979. 51 p, 18 Tab, 34 Ref.

Descriptors: *Effluents, *Biological treatment, *Sulfite liquors, *Pulp and paper industry, Pulp wastes, Waste water treatment, Rainbow trout, United States, Canada, Fishkill, Toxicity, Recovery systems, Treatment practices.

This study was conducted to determine whether conventional secondary biological treatment detoxifies sulphite pulp mill effluents. Seven sulphite pulp mills, varying in pulping base, wood species, type of treatment and recovery system and geographical location were studied. All mills were located in the United States and practiced some form of chemical recovery and biological treatment (aerated lagoons or activated sludge). Samples of mill effluents before and after biological treatment were collected four times over six months. Standard 96-hour static bioassays using rainbow trout (Salmo gairdneri) determined the LC50 value of each sample. Acute lethality was defined by a compliance standard of LC50 =

100%. Other routine analyses such as pH, biochemical and chemical oxygen demand, ammonia and total suspended solids were also conducted. Results of the study showed that all untreated effluents were acutely lethal and indicated that, in the majority of cases, biological treatment was capable of detoxifying the effluents. (WATDOC)
W80-02840

NITRIFICATION-DENITRIFICATION OF WASTEWATER USING A SINGLE-SLUDGE SYSTEM, VOLUME II,
Ontario Ministry of the Environment, Toronto. Wastewater Treatment Section.
A. G. Smith.
Available from Training and Technology Transfer Division (Water), Environmental Protection Service, Environment Canada, Ottawa, Ontario, Canada, K1A 1C8. Canada-Ontario Agreement on Great Lakes Water Quality, Research Report No 96, 1979, 67 p, 22 Fig, 13 Tab, 16 Ref, 21-1-20.

Descriptors: *Ferric chloride, *Inorganic carbon, *Phosphorus removal, *Nitrogen removal, Analytical data, Effluents, Biology, Ammonia, Sampling, Kleinberg, Ontario.

This report describes a full-scale evaluation of the split-return mode for nitrification-denitrification of a combined domestic/industrial wastewater. The investigation, which took place from July 1974 to December 1975 at the Ontario Ministry of the Environment's Ontario Experimental Facility at Brampton, followed pilot-studies at Kleinburg, Ontario. The evaluation investigated the effect of ferric chloride addition on phosphorous removal; the effect of solids retention times and sludge ages on nitrogen reactions at various temperatures; hydrogen peroxide addition and the use of a screen centrifuge on mixed liquor conditioning; as well as the suitability of the system for solids control and for maintenance of consistent nitrogen removal under different temperature conditions. It was concluded that the single-sludge, split-return system gave excellent nitrogen removal with minimal methanol application. Control of solids in both aeration and denitrification basins was easily accomplished by adjusting the return-split. On-site monitoring of the process was also easily accomplished. The lack of a clearly defined temperature effect on nitrogen metabolism was attributed to the long sludge retention time inherent in the system. (See also W79-07225) (WATDOC)
W80-02841

ADVANCED WASTEWATER TREATMENT TECHNOLOGY IN CANADA (1979),
Environmental Protection Service, Burlington (Ontario). Waste Water Technology Centre.
J. W. Schmidt.
Available from Environmental Protection Service, Environment Canada, Ottawa, Ontario, Canada KLA 1C8. Economic and Technical Review Report EPS 4-WP-79-5, August 1979, 57 p, 13 Fig, 21 Tab, 42 Ref.

Descriptors: *Waste water treatment, *Industrial wastes, *Municipal water, *Phosphorus, *Nitrogen, *Filtration, *Biochemical oxygen demand, Suspended solids, Ozone, Reverse osmosis, Treatment facilities, Technology, Feasibility studies, Basins, Great Lakes, British Columbia, Ontario, Saskatchewan.

Information is presented on the use of Advanced Wastewater Treatment (AWT) technology in Canada for the treatment of municipal wastewaters. AWT in the Canadian context is defined, specific requirements for the application of AWT are identified, and examples of the systems in use are described. In addition, Canadian pilot scale research and development efforts of recent years are discussed. Specific applications dealt with are the use of AWT for phosphorus removal, nitrogen conversion and removal, post filtration for BOD5 and suspended solids removal, studies on the use of ozone, reverse osmosis and the physical-chemical treatment of municipal wastewaters. In Canada, different approaches to AWT have been taken to resolve specific problems. The principal applications are physical-chemical treatment for phosphorus removal at over 140 mechanical plants, mainly in the Province of Ontario. The most popular method for phosphorus removal is accomplished by 'in plant' modifications to existing treatment systems. Effluent filtration to meet more stringent BOD5 and SS effluent criteria is practiced at a limited number of Canadian plants. (WATDOC)
W80-02842

WATER MOVEMENT IN A LAND TREATMENT SYSTEM OF WASTEWATER BY OVERLAND FLOW,
Army Terrestrial Sciences Center, Hanover, NH. Applied Research Branch.
For primary bibliographic entry see Field 2G.
W80-02853

THE MERRIMACK: DESIGNS FOR A CLEAN RIVER. ANNEX C: CONSULTANT'S INDUSTRIAL WASTEWATER PROFILES.
Weston (Roy F.) Inc., Boston, MA.
For primary bibliographic entry see Field 5E.
W80-02876

EFFECT OF PARTICULATES ON DISINFECTION OF ENTEROVIRUSES IN WATER BY CHLORINE DIOXIDE,
Cincinnati Univ., OH. Dept. of Civil Engineering.
P. V. Scarpino, F. A. O. Brigano, S. Cronier, and M. L. Zink.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-108301, Price codes: A04 in paper copy, A01 in microfiche. Report No EPA-600/2-79-054, July 1979, 67 p, 22 Fig, 9 Tab, R-804418.

Descriptors: *Disinfection, *Chlorine, *Particle size, *Viruses, *Turbidity, Water pollution sources, Chlorination, Enteric bacteria, E. coli, Sewage bacteria, Microorganisms, Potable water, Water purification, Water supply, Chlorine dioxide.

The use of chlorine dioxide as a waste water disinfectant was examined in laboratory studies using the organisms poliovirus 1, coxsackievirus A9, and Escherichia coli. Chlorine dioxide is being considered as a disinfectant for drinking water due to its reduced formation of carcinogenic compounds when compared to chlorine. Experiments were conducted to determine the effects of particulates, temperature, contact times, pH values, and viral aggregation on the disinfectant levels produced by chlorine dioxide. The two viruses tested were significantly more resistant to chlorine dioxide disinfection than the bacterial organism, e. coli. Viral aggregation was found to effect disinfection rates. Cell-associated polioviruses showed no greater resistance than unassociated polioviruses probably due to the existence of the associated poliovirus in a non-aggregate state. An inverse correlation was found between bentonite protection of poliovirus disinfection and rising turbidity and temperature. As bentonite turbidity and temperature increase, disinfection decreases for bentonite-adsorbed poliovirus. Overall at the pH of most drinking waters chlorine dioxide was found to be an excellent disinfectant. (Seigler-IPA)
W80-02998

5E. Ultimate Disposal Of Wastes

EFFECTS OF FLUE GAS CLEANING WASTE ON GROUNDWATER QUALITY AND SOIL CHARACTERISTICS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-118656, Price codes: A07 in paper copy, A01 in microfiche. Report No EPA-600/2-79-164, August 1979. 128 p, 23 Fig, 64 Tab, 26 Ref, 3 Append.

Descriptors: *Sludge disposal, *Leaching, *Stabilization, *Lagoons, Groundwater, Aquifers, Hydrogeology, Path of pollutants, Soil contamination, Water pollution, Calcium, Boron, Water sampling, Permeability, Sulfur compounds.

Three unlined, unstabilized power plant waste disposal ponds containing flue gas cleaning (FGC) sludges located in different geological circumstances were studied to assess the extent of pollutant migration into the local groundwater and the effects on surrounding soils. Examination of the three geological settings identified two major types, one site was underlain by impermeable materials (clay and shale) and two of the sites were underlain by relatively permeable silty sands and gravel with finer materials discontinuously distributed throughout. A probable pattern of leachate movement and attenuation was used to identify the locations for borings for water and soil sampling. Results indicate that: (1) FGC sludge/ash ponds are not self-sealing, (2) at all three sites FGC sludge/ash-related materials had moved into surrounding soils and groundwater, and (3) soils below the ponds do not permanently retain any of the pollutants except calcium and boron. The site with impermeable substrata showed no permeability change related to the pond.At one of the sites with permeable substrata changes in permeability, dry density, water content, and percent fines were related to the pond. Overall FGC sludge/ash disposal sites can pollute groundwaters and are a threat to drinking water aquifers. Planning for FGC sludge/ash disposal areas should include a groundwater monitoring program. (Seigler-IPA)
W80-02726

THE MERRIMACK: DESIGNS FOR A CLEAN RIVER. ANNEX C: CONSULTANT'S INDUSTRIAL WASTEWATER PROFILES.
Weston (Roy F.) Inc., Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A041 682, Price codes: A09 in paper copy, A01 in microfiche. Prepared for U.S. Army Corps of Engineers, New England Division, August 1974. 174 p.

Descriptors: *Waste water treatment, *Industrial wastes, *Chemical wastes, *Waste water(Pollution), *Textiles, *Plastics, *Pulp and paper industry, *Tannery wastes, *Effluents, *Water pollution, *Water pollution sources, *Merrimack River(MA), *Metal plating wastes, Waste water disposal, Liquid wastes, Bleaching wastes, Cotton, Fabrics, Fibers(Plant), Polymers, Resins, Pulp wastes, Cellulose.

Annex C is a compendium of five reports. The first is an assessment of some significant wastewater disposal aspects of the plastics industry. Particular attention is paid to how this industry will affect a wastewater management program for the Merrimack River Basin. Studied are manufacturing processes and wastewater characteristics, sources and loading associated with polymer production. Brief discussions and data relative to specific polymers and resins are presented. Treatment systems are suggested and costs analyzed. The second report is an industrial wastes profile of metal plating wastes in the basin. A typology is presented. The effects of these wastes on sewers, treatment plant processes, receiving wastes and water supplies is reviewed. Conventional treatment practices are outlined and current developments in metal plating waste treatment evaluated. The third report surveys the waste problems of the textile industry. It reviews the causes of pollution in the industry and then studies effluents from specific types of cloth and textile plants. Plants include those dealing with cotton and cotton blends, wool, synthetics and nonwoven fabrics. Report four studies the nature and treatment of tannery effluents. Both upper side leather manufacturing and sheepskin suede leather manufacturing processes are discussed and particular effluents from each stage of manufacturing are identified. The last report outlines paper effluents. Each step of the papermaking process and the resulting effluent are studied. Pretreatment and primary, secondary and tertiary treatments are evaluated. (Zayac-NC)
W80-02876

5F. Water Treatment and Quality Alteration

OZONE AND ULTRAVIOLET RADIATION DISINFECTION FOR SMALL COMMUNITY WATER SYSTEMS,
Vermont State Dept. of Health, Burlington.
L. E. Witherell, R. L. Solomon, and K. M. Stone.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-108418, Price codes: A03 in paper copy, A01 in microfiche. Report No EPA-600/2-79-060, July 1979. 46 p, 5 Fig, 15 Tab, 41 Ref. 68-03-2182

Descriptors: *Disinfection, *Ozone, *Ultraviolet radiation, *Chlorination, Water treatment, Water purification, Operating and maintenance, Aquatic bacteria, Coliforms, Water sampling, Vermont, Water distribution(Applied), Water quality, Water storage.

Ozone and ultraviolet radiation were compared to chlorination as disinfectants for small water systems. Due to inadequately trained operators and poor maintenance, the use of chlorination in small community water systems often results in inadequate disinfection. Areas compared included disinfection capability, operation and maintenance requirements, and costs. Five existing small water systems in Grand Isle County, Vermont, were used for the comparison. Ultraviolet radiation disinfection units were installed at two sites, ozone disinfection units at two sites, and the fifth system was unchanged from its unfiltered chlorination system. Data were collected for 3 to 21 months. Results show that both ozone and ultraviolet radiation are inferior to chlorination in the areas of operation, maintenance requirements, and the retention of disinfection levels in water distribution systems. It was also found that even in small water systems a disinfectant residual such as that provided by chlorination but not by ozonation or ultraviolet radiation is needed to maintain proper disinfection in distribution systems. (Seigler-IPA)
W80-02725

THE EFFECTS OF CALCIUM, ALUM AND PH ON THE REMOVAL OF NATURALLY OCCURRING MANGANESE BY RAPID SAND FILTRATION,
Auburn Univ., AL. Dept. of Civil Engineering.
M. J. Keal.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-135148, Price codes: A04 in paper copy, A01 in microfiche. MS Thesis, December 13, 1979. 66 p, 15 Fig, 21 Ref. OWRT A-064-ALA (1).

Descriptors: *Manganese, *Sands, *Filtration, *Water treatment, Aluminum, Lime, Calcium compounds, Domestic water, Water quality, Water types, Flocculation, Chemical precipitation, Water purification, Water quality standards, Alabama.

Water samples from Lake Saugahatchee, the water supply for Opelika, Alabama, were used in tests to determine the effects of chemical additive on manganese removal by sand filtration. Varying concentrations of calcium nitrate were added to samples of natural water containing oxidized manganese. The samples were run through a sand filter and the amount of manganese not removed was measured. The most effective calcium concentration gave a manganese removal rate of 70%. This concentration was then tested with varying pH conditions. Samples were also run with additions of alum, and aluminum sulfate, at various pH levels. Finally, tests were run with calcium added as lime. Results show: (1) sand filtration alone removes little manganese; (2) calcium addition does improve manganese removal; (3) increased pH has a positive effect on manganese removal when calcium is added; and (4) alum addition improves manganese removal. Contributions of alum and calcium additions were also found to increase manganese removal. Application of study results should be valuable in southern treatment systems where high manganese and low calcium concentrations naturally exist. (Seigler-IPA)
W80-02767

LAKE RESTORATION BY NUTRIENT INACTIVATION,
Washington State Univ., Pullman. Dept. of Civil and Environmental Engineering.
W. H. Funk, and H. L. Gibbons.
In: Lake Restoration, Report No EPA 440/5-79-001, p 141-151, 1979. 15 Fig, 10 Tab, 31 Ref.

Descriptors: *Eutrophication, *Nutrients, *Chemical precipitation, Water treatment, Chemical reactions, Phosphorus, Aluminum, Algal control, Aquatic algae, Lakes, Lake stages, Chlorophyll, Dissolved oxygen, Water pollution treatment.

Nutrient inactivation is accomplished by the addition of a chemical precipitant such as aluminum, iron, or calcium to polluted water. The nutrients in the polluted water bond with the precipitant and become unavailable for nuisance algal and plant growth. While nutrient inactivation has been a common wastewater treatment technique, it has only recently been used to any appreciable extent for lake restoration. Aluminum is the most widely used lake nutrient inactivant. Nutrient inactivation projects and results are discussed for Horseshoe Lake in Wisconsin, Twin and Dollar Lakes in Ohio, Medical and Liberty Lakes in Washington, and Cline's Pond in Oregon. In most nutrient inactivation projects there is an immediate reduction of available phosphorus. Nutrient inactivation is relatively inexpensive when compared to many algicides, however, costs rapidly increase for the treatment of large lakes. Care must be taken to determine and to add the correct amount of inactivant since too much inactivant causes a drop in pH organisms and fish. Nutrient inactivation has a 2-3 year effective period and therefore is not a long term solution to eutrophication problems. (See also W80-02773) (Seigler-IPA)
W80-02796

5G. Water Quality Control

COMPUTER-AIDED STREAM POLLUTION CONTROL AND MANAGEMENT, PART I,
New York State Dept. of Environmental Conservation, White Plains.
M. H. Wang, L. K. Wang, J. F. Kao, C. G. Wen, and D. Vielkind.
Journal of Environmental Management, Vol 9, p 165-183, 1979. 3 Tab, 2 Fig, 13 Ref.

Descriptors: *Environmental management, *Planning, *Stream pollution control, Dissolved oxygen, Biochemical oxygen demand, Multiple linear correlation method, Mathematical models, Computer program.

A comparison between the Streeter-Phelps method and the Churchill and Buckingham method is made for the computation of dissolved oxygen deficit and organic waste loads on a receiving stream. Principles of multiple linear correlation are described. Normal equations, standard error equation and correlation coefficient equation are derived. Two mathematical models involving the multiple linear correlation of four critical parameters (dissolved oxygen, biochemical oxygen demand, water temperature and river flow) near a point source of pollution are derived with a FORTRAN computer program. (See also W80-02702)
W80-02701

COMPUTER-AIDED STREAM POLLUTION CONTROL AND MANAGEMENT, PART II,
Stevens Inst. of Tech., Hoboken, NJ.
L. K. Wang, M. H. Wang, J. F. Kao, and C. G. Wen.
Journal of Environmental Management, Vol 9, p 185-204, 1979. 1 Fig, 2 Tab, 11 Ref.

Descriptors: *Environmental management, *Planning, *Stream pollution control, Dissolved oxygen, Biochemical oxygen demand, Multiple linear correlation method, Mathematical models, Computer program.

The dissolved oxygen drop is a function of the combined biochemical oxygen demand loads of upstream, the temperature of stream water and the stream flow. A mathematical model which adequately expresses this function can be developed by means of the multiple linear correlation method. This paper describes the methods and the procedures used for mathematical modelling. Practical examples are presented and discussed. (See also W80-02701)
W80-02702

INTERNATIONAL WATER USE RELATIONS ALONG THE SONORAN DESERT BORDERLANDS,
Arizona Univ., Tucson. Office of Arid Lands Studies.
M. H. Jamail, and S. J. Ullery.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-134976, Price codes: A08 in paper copy, A01 in microfiche. Arid Lands Resource Information Paper No 14, 1979. 146 p, 8 Fig, 1 Tab, 355 Ref. OWRT-C-90004-W (9604)(1), 14-34-0001-9604.

Descriptors: *International waters, *International Bound and Water Comm, *Water pollution sources, *Colorado River, *Mexico, *Governmental interrelations, Mexican Water Treaty, Colorado River Basin, Arizona, California, International Commission, Water quality, Legal aspects, Documentation, Bibliographies.

Water resources in the arid-semiarid region of the Sonoran Desert Borderlands are, and historically have been, difficult to manage due to the artificial political boundary between Mexico and the United States. The current state of water use relations in this area are examined from published and unpublished articles and manuscripts, government reports and hearings, press reports, first-hand observations, and interview with officials and other involved individuals. Water resources areas examined include international groundwater, surface water, and water pollution. The International Boundary and Water Commission (IBWC) is designed to deal with these issues, however, rapid urbanization along the border with its accompanying municipal and industrial water demands has created new conflict areas other than the long-standing conflict over agricultural water use. IBWC has a limited scope of authority and is inadequate in resolving issues where sound water management is secondary to political considerations. President Carter and President Lopez Portillo have made a commitment to solve the increasing pollution problems. Study documentation is presented including a bibliography with keyword and author indexing, supplementary references, press reports, file references, interviews, maps, and photographs. (Seigler-IPA)
W80-02766

A SIMPLE POLLUTION VULNERABILITY INDEX FOR PRELIMINARY COASTAL WATER QUALITY MANAGEMENT PLANNING,
Maine Univ. at Orono. Land and Water Resources Center.
B. J. Edwards, and F. E. Woodard.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-134323, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, October 1979. 29 p, 6 Fig, 2 Tab, 34 Ref, 1 Append. OWRT A-047-ME (1).

Descriptors: *Coasts, *Water pollution control, *Water quality control, *Maine, Mathematical models, Sea water, Industrial wastes, Aquatic life, Coliforms, Water pollution sources, Shellfish, Pollutants, Path of pollutants, Vulnerability, Water management(Applied).

A quantitative pollution vulnerability index was developed for locating future coastal discharge in Maine so that deleterious effects are minimized. The index is designed to serve as a planning tool for agencies in coastal zone management. The vulnerability of a coastal zone is determined by its capacity to accept a particular pollutant which is a function of dispersion, background pollutant levels, and allowable limits. The intended use of an area of water determines the maximum allowed concentration. In many cases this intended or designated

use is defined in the Maine State Coastal Classification System. Data on background pollutant levels was obtained from the State of Maine Sea and Shore Fisheries, the Department of Environmental Protection, and other private sources. In most cases the data are site-specific and estimates must be used until more detailed data are available. The Weyl 'pollution susceptibility index' is used because it is mathematically simple and requires minimal input data. Because levels of critical use are not well defined for a wide range of pollutants, fecal coliform is used for an example. Study conclusions are: (1) vulnerability can be expressed numerically to compare one area to another for a particular pollutant, (2) allowable limits for different pollutants with respect to various marine organisms needs to be determined, (3) data on pollutant background levels is currently insufficient, and (4) vulnerability index use is limited due to a lack of 'use-allowable limit' relationships for pollutants. (Seigler-IPA)
W80-02768

SEPARATION OF OIL FROM WATER,
Dow Chemical Co., Midland, MI. (Assignee).
R. H. Hall, D. H. Haigh, and E. G. Larson.
U.S. Patent No 4,172,031, 6 p, 4 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 987, No 4, p 952, October 23, 1979.

Descriptors: *Patents, *Oil pollution, *Water quality control, Oily water, Separation techniques, Adsorption, Resins, Equipment, Oleophilic properties.

Water containing traces of oil is cleaned by passing through a porous bed containing oleophilic bodies and oil imbibing bodies. Oil is collected on the surface of the oleophilic bodies and removed from the oleophilic bodies by the oil imbibing bodies. Such beds have a high capacity for oil retention while maintaining separating efficiency. The apparatus comprises means defining a stream receiving channel and a first sorption bed transverse in the channel. The first sorption bed is permeable to water and in sealing engagement with the channel so that water flowing within the channel must flow through the bed. The bed comprises a first oleophilic surface and at least one organic liquid swellable synthetic resinous body in contact with the oleophilic surface. (Sinha - OEIS)
W80-02771

SECONDARY SALINIZATION AND SODICATION IN EGYPT: A CASE STUDY,
Alexandria Univ. (Egypt).
M. M. El-Gabaly.
Water Supply and Management, Vol 3, No 3, p 179-199, 1979. 26 Ref.

Descriptors: *Egypt, *Salinity, *Soils, *Secondary salinization, *Sodication, *Alkaline soils, Saline soils, *Soil management, Soil analysis, Land reclamation, Soil investigations, Agriculture, Agricultural practices, Irrigation, Leaching, Land management, Land, Saline water, Pollution(soils), Impoundments.

The study assesses the land resources affected by secondary salinization and sodication in Egypt. Secondary salinization is the result of man's failure to control the salt regime of the soil; the rate and extent varies according to natural factors such as landscape, ground water hydrology, and geochemistry. Salinization and sodication are linked geomorphologically to low lands such as the northern part of the Nile Delta. Soil and agronomic practices inducive to secondary salinization under Egyptian conditions include poor levelling, fallowing, cropping pattern, insufficient leaching and formation of a plowsol layer resulting from repeated tillage at a given depth. Reclamation techniques and measures for controlling secondary salinization include drainage, soil improvements, leaching, addition of gypsum, control of seepage, on-farm water use and soil and agronomic practices. Studies for both prognosis and monitoring of salinity and sodicity include soil and hydrological surveys, field and laboratory measurements, satellite imagery and crop performance. A successful reclamation program should accomplish reduction of salt content in root zones, lowering of water table below the critical level, desalination of ground water, and prevention of resalinization of soil. Specific management practices are suggested to accomplish this. (Iervolino-NC)
W80-02858

PERFORMANCE OF AN AXIAL FLOW PUMP FOR LAKE DESTRATIFICATION,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2H.
W80-02879

IRRIGATION MANAGEMENT FOR RIVER-SALINITY CONTROL,
Utah State Univ., Logan. Dept. of Civil and Environmental Engineering.
J. P. Riley, and J. J. Jurinak.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol 105, No IR4, Proceedings Paper 15023, p 419-432, December 1979. 3 Fig, 2 Tab, 9 Ref, 2 Append.

Descriptors: *Salinity, *Rivers, *Irrigation, *Irrigation effects, *Colorado River, Data collections, Return flow, Irrigation practices, Salts, Water quality, Water quality control, Management(Applied), Model studies, Mathematical models, Simulation analysis, River systems, Agriculture, Farm management.

The salinity of a given river system is the result of both salt-concentrating and salt-loading effects. Concentrating effects are produced by evaporation, diversion of high-quality water from the basin, and consumptive use by natural vegetation and by irrigated crops. The salt loading effects occur through dissolving action in the soil and the underlying materials. The water for this latter process originates from both irrigation applications and from precipitation that infiltrates into the soil matrix. Because a significant contribution to the total salt load of the upper Colorado River system originates from irrigation return flows, a procedure is needed that will predict the effects of irrigation management on salt inputs to the river. The paper presented the concepts and input data used in developing a one-dimensional streamflow and salt mass-balance model for long-run average effects of irrigation efficiency on salinity. (Sims-ISWS)
W80-02908

MANAGING STORM RUNOFF IN CHICAGO AREA,
Metropolitan Sanitary District of Greater Chicago, IL.
B. T. Lynam, F. C. Neil, and F. E. Dalton.
Journal of the Technical Councils of ASCE, American Society of Civil Engineers, Vol 105, No TC2, Proceedings Paper 15035, p 401-413, December 1979. 5 Fig, 7 Ref.

Descriptors: *Flood control, *Illinois, *Water quality control, *Drainage, *Cities, *Planning, Storage, Underground storage, Reservoir storage, Runoff, Storm runoff, Urban runoff, Tunneling, Tunnels, Water quality, Hydrology, Sanitary engineering, *Chicago(IL).

Existing combined sewers in the Chicago area discharge a mixture of storm water runoff and sewage to the rivers about 100 times/year and on occasions overload the river system making it necessary to reverse the flow of the river system into Lake Michigan. Storm water and drainage in the combined sewer area will be managed by a system of tunnels and reservoirs under construction. In the separate sewered area, a system of reservoirs, channel improvements, and land treatment is being implemented; and, to reduce the erosion and siltation problems of the rivers and streams, on-site detention in new residential and industrial developments is being required. Thus, the goals of Chicago's Areawide Wastewater Management Program are comprehensive, including simultaneous flood control and water quality improvements. (Sims-ISWS)
W80-02914

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

STORM DRAINAGE PIPES -- HOW BIG SHOULD THEY BE,
Working Party on the Hydraulic Design of Storm Sewers (England).
P. Colyer.
Water, No 28, p 57-59, September 1979. 2 Fig, 2 Ref.

Descriptors: *Storm drains, *Storm runoff, *Urban drainage, Drainage systems, Urban hydrology, Pipes, Combined sewers, Overland flow, Hydrographs, Precipitation(Atmospheric), Computer models, Computer programs, Model studies, Rainfall-runoff relationships, Rainfall intensity.

The United Kingdom's Working Party on the Hydraulic Design of Storm Sewers is developing a computerized economic methodology for use by engineers in the design of storm drainage systems. Major areas of concern in storm sewer design are rainfall, overland flow, pipe flow and sewer ancillaries, and costs and economics. Because rainfall durations and intensities vary the computer programs are designed to use four rainfall durations. The programs can also simulate drainage system behavior under various observed rainfall conditions. Catchment characteristics were used to calculate the necessary equations for modelling overland flow characteristics. The Muskingum-Cunge routing technique is used for most applications concerning pipe flow. Storm overflows, on-line and off-line tanks, and pumping stations can currently be simulated by the system. The program also has provisions for costs and economic evaluations. Because the program is modular it can be modified to fit assorted user needs. Uses include the analysis of existing storm sewer systems as well as the design of new systems. System methods available include: a modified Rational method; a general hydrogrpah method; a design method for pipe depths, gradients, and diameters; and a performance calculating method. The system is currently being tested by three methods and programs and manuals should be available late in 1980. (Seigler - IPA)
W80-02758

ENVIRONMENTAL QUALITY AND RESIDUALS MANAGEMENT,
Resources for the Future, Washington, DC.
For primary bibliographic entry see Field 6B.
W80-02846

MODELS FOR WATER RESOURCES DECISION-MAKING: PROBLEMS AND PROJECTS,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
A. K. Biswas.
Water Supply and Management, Vol 3, No 1, p 1-7, 1979.

Descriptors: *Decision making, *Mathematical models, *Methodology, *Computer models, *Model studies, *Water resources, Statistical models, Mathematical studies, Administration, Alternate planning, Analytical techniques, Water resources planning, Management.

The modeling approach to water resources management is claimed to be primarily an academic exercise that is seldom used to solve real life problems. The first and foremost reason for this 'credibility gap' is that the proponents of mathematical modeling and computer technology generally have done a poor job of translating outputs into terms that are readily understandable to those not so intimately involved in the art. In addition to the bulky volumes of data, the results of modeling efforts are seldom presented in simple, straightforward, and meaningful ways. Another reason for the development of the credibility gap is the lack of user involvement in the development process. Another problem is the myth that the problem is too costly and time consuming. Remedies to these

problems must begin with the modelers showing that this mode of analysis not only has tremendous potential for problem analysis but that it can actually be used today to make decisions rationally and effectively. Communication can be improved through the following ways: (1) define concisely the decision maker's problem and information requirements; (2) conduct 'hands-on' workshops using simple but practical examples of how decision capability can be enhanced by considering a host of different alternatives within the modeling process; (3) illustrate some real cases in straightforward and understandable terms, and (4) develop improved methods for displaying mode results or results of model applications. (Iervolino-NC)
W80-02860

MATHEMATICAL PROGRAMMING MODELS APPLIED TO WATER RESOURCES PLANNING,
Tottori Univ. (Japan). Dept. of Civil Engineering.
N. Okada, and K. Yoshikawa.
Water Supply and Management, Vol 3, No 3, p 205-223, 1979. 14 Ref, 12 Fig, 5 Tab.

Descriptors: *Mathematical models, *Mathematical studies, *Programming, *Model studies, *Analytical techniques, *Kakogawa River Basin(Japan), *Hyogo prefecture(Japan), *Decision making, *Goal programming, *Water resources, Linear programming, Mathematics, Cost-benefit ratio, Cost allocation, Multiple objectives planning, Cost analysis, Planning, Management, River basins.

The purpose of this paper is to illuminate the potential and limitations of mathematical methodology as applied to structured information for use of planners and decision makers in deciding on water development systems under limited resources availability. Three kinds of water resources allocation problems are discussed: (1) cost minimization, (2) cost allocation, and (3) multiple objectives. The model for (1) deals with developing a single-(intra-) basin water resources system and consists of one objective function which accounts for total costs and 30 constraints associated with the mass balance condition of water quantity and the prescribed condition for water quality regulation. The model is a nonlinear program with the specific characteristic that a greater part of the constraints are linear. For the cost allocation problem the process is initiated by completion of an inventory of total costs for a set of possible coalitions with the aid of a nonlinear programming model. In terms of the n-person cooperative game, the problem of allocating the total cost among members of a given coalition is formulated as the determination of payoff vector (Xi) which represents a set of assigned portions of the cost to player i (i=1,...,n). For the final problem a mathematical methodology by use of goal programming (an extension of linear programming) is used which specifies two levels for each objective--the permissible and the satisfactory. Case studies were applied in the Kakogawa River basin and the southern part of the Hyogo Prefecture, Japan. Use of these models provides planners and decision makers with a manageable set of promising alternatives for water resource planning. (Iervolino-NC)
W80-02863

AN OVERVIEW OF RIVER-BASIN ASSESSMENT TECHNIQUES IN AN ENERGY-IMPACTED REGION--YAMPA RIVER BASIN, COLORADO AND WYOMING,
Geological Survey, Lakewood, CO.
T. D. Steele.
Water Supply and Management, Vol 3, No 3, p 151-171, 1979. 10 Fig, 2 Tab, 29 Ref.

Descriptors: *Water resources, *River basins, *Energy, *Yampa River Basin, *Colorado, *Wyoming, *Energy Resource Development, *Water Resources Development, *Water demand, Assessments, Model studies, Ambient stream quality, Sediment, Reservoirs, Analysis, Groundwater, Remote sensing, Air quality, Decision-making, Management, Impacts, Coal, Modeling studies.

With increasing development of coal production, there is concern over increased water demand and anticipated environmental impacts associated with coal mining, particularly in the Rocky Mountain States which have small populations and limited water resources. These assessment studies focus on the Yampa River basin in northwestern Colorado and south-central Wyoming, and involve that part of the basin east of Dinosaur National Monument. Objectives include: (1) to evaluate the environmental and economic impacts of regional energy- and water-resource development for existing and feasible alternative policies, and (2) to describe the assessment methodologies used so that they may be applied to other energy-rich regions of the western U.S. where water resources are limited. The major energy resource in the basin consists of near-surface coal deposits; other resources--oil and gas, oil shale, uranium and geothermal springs--also occur in the basin. The regional-appraisal and modeling studies used in this assessment are: ambient stream quality, stream traveltime and re-aeration characteristics, waste-load assimilative capacity, sediment loadings in streams, reservoir-modeling analysis, groundwater solute transport, remote-sensing applications and air quality modeling. In this assessment concern was given to projected increased water uses and how they are to be met within existing use patterns and other institutional constraints. Continuing studies such as these will enable resource managers to anticipate potential problems concerning the impending coal-resource development in the Yampa River basin. (Iervolino-NC)
W80-02865

STATE-OF-THE-ART OF GROUNDWATER MODELING,
Camp, Dresser, and McKee, Inc., Champaign, IL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W80-02866

PRECONSTRUCTION AND POSTCONSTRUCTION GROUND-WATER LEVELS, LOCK AND DAM 4, RED RIVER VALLEY, LOUISIANA,
Geological Survey, Little Rock, AR. Water Resources Div.
A. H. Ludwig, and J. E. Reed.
Geological Survey open-file report 79-921, June 1979. 22 p, 7 Ref, 6 Plates, 3 Tab, 14 Ref.

Descriptors: *Model studies, *Surface-groundwater relationships, *Potentiometric level, *Pre-impoundment, *Post-impoundment, Navigation, Rivers, Locks, Dams, Effects, Groundwater, Water levels, Aquifer characteristics, Alluvial aquifers, Groundwater recharge, Water table, Flood plains, Louisiana, *Red River(LA), Red River Valley(LA), Lock and dam 4.

Proposed construction of a series of locks and dams in the Red River in Louisiana will cause a permanent increase in average river stage. The potentiometric surface of the shallow alluvial aquifer and the water table in the fine-grained material confining the aquifer will be affected. The purpose of this study, using digital-modeling techniques, was to predict the average postconstruction potentiometric surface (steady state) and the water table (nonsteady state) so that potential effects of the water-level changes could be evaluated. Plans for lock and dam 4 at realined mile 154 (kilometer 250) above the mouth of the Red River call for a pool elevation of 115 feet (35 meters) and will cause an average increase in river stage ranging from 24 to 4.5 feet (7 to 1.4 meters). As a result, ground-water levels will be raised 1 foot (0.3 meter) or more between the Red River and Bayou Pierre from the dam to Coushatta, and below Campti, east of the river. The potentiometric surface may be at or near land surface in low areas between the Red River and Bayou Pierre, and above land surface locally upstream from the dam. The magnitude of ground-water-level fluctuations near the river will be reduced to less than half the present range. (Woodard-USGS)
W80-02919

PRECONSTRUCTION AND POSTCONSTRUCTION GROUND-WATER LEVELS, LOCK AND DAM 3, RED RIVER VALLEY, LOUISIANA,
Geological Survey, Little Rock, AR. Water Resources Div.
A. H. Ludwig, and J. E. Terry.
Geological Survey open-file report 79-920, June 1979. 21 p, 7 Fig, 6 Plates, 3 Tab, 11 Ref.

Descriptors: *Model studies, *Surface-groundwater relationships, *Potentiometric level, *Pre-impoundment, *Post-impoundment, Navigation, Rivers, Locks, Dams, Effects, Groundwater, Water levels, Aquifer characteristics, Alluvial aquifers, Groundwater recharge, Water table, Flood plains, Louisiana, *Red River(LA), Red River Valley(LA), Lock and dam 3.

Proposed construction of a series of locks and dams in the Red River in Louisiana will cause a permanent increase in average river stage. The potentiometric surface of the shallow alluvial aquifer and the water table in the fine-grained material confining the aquifer will be affected. The purpose of this study, using digital-modeling techniques, was to predict the average postconstruction potentiometric surface (steady state) and the water table (nonsteady state) so that potential effects of the water-level changes could be evaluated. Plans for lock and dam 3 at realined mile 111 (kilometer 179) above the mouth of the Red River call for a pool elevation of 87 feet (27 meters) and will cause an average increase in river stage ranging from 21 to 3.5 feet (l.4 to 1.1 meters). As a result, groundwater levels will be raised to near land surface in low areas east of the river from the damsite to Aloha and in a 0.5-mile (0.8-kilometer) strip along the west side extending 9 miles (14 kilometers) above the dam. The potentiometric surface may be above land surface locally near the dam. The magnitude of ground-water-level fluctuations near the river will be reduced to less than half the preconstruction range. (Woodard-USGS)
W80-02920

PRECONSTRUCTION AND POSTCONSTRUCTION GROUND-WATER LEVELS, LOCK AND DAM 2, RED RIVER VALLEY, LOUISIANA,
Geological Survey, Little Rock, AR. Water Resources Div.
A. H. Ludwig.
Geological Survey open-file report 79-919, June 1979. 18 p, 8 Fig, 4 Plates, 10 Ref.

Descriptors: *Model studies, *Surface-groundwater relationships, *Potentiometric level, *Pre-impoundment, *Post-impoundment, Navigation, Rivers, Locks, Dams, Effects, Groundwater, Water levels, Aquifer characteristics, Alluvial aquifers, Groundwater recharge, Water table, Flood plains, Louisiana, *Red River(LA), Red River Valley(LA), Lock and dam 2.

Proposed construction of a series of locks and dams in the Red River in Louisiana will cause a permanent increase in average river stage. The potentiometric surface of the shallow alluvial aquifer and the water table in the fine-grained material confining the aquifer will be affected. The purpose of this study using digital-modeling techniques, was to predict the average postconstruction potentiometric surface (steady state) and the water table (nonsteady state) so that potential effects of the water-level changes could be evaluated. Plans for lock and dam 2 at mile 87 (kilometer 140) above the mouth of the Red River call for a pool elevation of 58 feet (17.7 meters) and will cause an average increase in river stage of 12.5 feet (3.8 meters). As a result, ground-water levels will be raised 1 foot (0.3 meter) or more within 4 miles (6.4 kilometers) of the river and will be near land surface in low areas. The potentiometric surface may be as much as 1 to 2 feet (0.3 to 0.6 meter) above land surface south of Latanier along Chatlin Lake Canal and south of the Annandale area of Alexandria. The magnitude of ground-water-level fluctuations near the river will be reduced. (Woodard-USGS)
W80-02921

PRECONSTRUCTION AND POSTCONSTRUCTION GROUND-WATER LEVELS, LOCK AND DAM 1, RED RIVER VALLEY, LOUISIANA,
Geological Survey, Little Rock, AR. Water Re-

sources Div.
A. H. Ludwig.
Geological Survey open-file report 79-918, June 1979. 17 p, 8 Fig, 2 Plates, 9 Ref.

Descriptors: *Model studies, *Surface-groundwater relationships, *Potentiometric level, *Pre-impoundment, *Post-impoundment, Navigation, Rivers, Locks, Dams, Effects, Groundwater, Water levels, Aquifer characteristics, Alluvial aquifers, Groundwater recharge, Water table, Flood plains, Louisiana, *Red River(LA), Red River Valley(LA), Lock and dam 1.

Proposed construction of a series of locks and dams in the Red River in Louisiana will cause a permanent increase in average river stage. The potentiometric surface of the shallow alluvial aquifer and the water table in the fine-grained material confining the aquifer will be affected. The purpose of this study, using digital-modeling techniques, was to predict the average postconstruction potentiometric surface (steady state) and the water table (nonsteady state) so that potential effects of the water-level changes could be evaluated. Plans for lock and dam 1 at mile 44 (kilometer 71) above the mouth of the Red River call for a pool elevation of 40 feet (12.2 meters) and will cause an average increase in river stage of 9 feet (2.7 meters). As a result, ground-water levels will be raised 1 foot (0.3 meter) or more within 4 miles (6.4 kilometers) of the river. The potentiometric surface may be near land surface in low-lying areas, and above land surface along the course of drainage features near the dam. The magnitude of ground-water-level fluctuations near the river will be reduced. (Woodard-USGS)
W80-02922

PRECONSTRUCTION AND POSTCONSTRUCTION GROUND-WATER LEVELS, LOCK AND DAM 5 AND 6, RED RIVER VALLEY, LOUISIANA,
Geological Survey, Little Rock, AR. Water Resources Div.
A. H. Ludwig, and J. E. Terry.
Geological Survey open-file report 79-922, June 1979. 24 p, 7 Fig, 4 Plates, 3 Tab, 14 Ref.

Descriptors: *Model studies, *Surface-groundwater relationships, *Potentiometric level, *Pre-impoundment, *Post-impoundment, Navigation, Rivers, Locks, Dams, Effects, Groundwater, Water levels, Aquifer characteristics, Alluvial aquifers, Groundwater recharge, Water table, Flood plains, Louisiana, *Red River(LA), Red River Valley(LA), Lock and dam 5 and 6.

Proposed construction of a series of locks and dams in the Red River in Louisiana will cause a permanent increase in average river stage. The potentiometric surface of the shallow alluvial aquifer and the water table in the fine-grained material confining the aquifer will be affected. The purpose of this study, using digital-modeling techniques, was to predict the average postconstruction potentiometric surface (steady state) and the water table (nonsteady state) so that potential effects of the water-level changes could be evaluated. Plans for lock and dam 5 at mile 243 (kilometer 390) above the mouth of the Red River call for a pool elevation of 145 feet (44 meters) and will cause an average increase in river stage of 23 feet (7.0 meters). As a result, ground-water levels in the pool area will be raised to near land surface in much of the area between the river and Bayou Pierre and as much as 2 miles (3.2 kilometers) east of the river from the dam upstream to realined mile 220 (kilometer 350). Areas of Barksdale Air Force Base where levels are now near land surface would be enlarged and extend downstream along Flat River to near Curtis. The potentiometric surface may be above land surface near Howard, Anderson Island, and Dixie Gardens. (Woodard-USGS)
W80-02923

COMPUTER SIMULATION AND GEOHYDROLOGY OF A BASALT AQUIFER SYSTEM IN THE PULLMAN-MOSCOW BASIN, WASHINGTON AND IDAHO,
Geological Survey Tacoma, WA. Water Resources Div.
R. A. Barker.
Washington Department of Ecology Water-Supply Bulletin 48, 1979. 119 p, 40 Fig, 1 Plate, 4 Tab, 78 Ref.

Descriptors: *Water level fluctuations, *Groundwater basins, *Model studies, *Drawdown, *Withdrawal, Water wells, Water supply, Water demand, Projections, Aquifer characteristics, Basalts, Aquifer management, Simulation analysis, Washington, Idaho, *Pullman-Moscow basin(Wash-Idaho).

A digital-computer model, using a finite-difference technique, was developed to simulate hydrologic characteristics of a basalt aquifer system in the Pullman-Moscow basin, Washington and Idaho. The model should benefit water agencies by providing for evaluations of various water-management alternatives involving the distribution of well pumping and artificial recharge. The modeled aquifer system underlies about 88,000 acres in the basin and is mostly in the Columbia River Basalt Group. Water-level decline began in the 1890's and by 1975 water levels had declined nearly 80 feet below those of predevelopment conditions. The decline has resulted from year-to-year increases in pumping and a small amount of natural recharge. Pumpage averaged about 6,600 acre-feet per year during 1971-75. Simulation suggests that vertical leakage from upper aquifers is the most important source of recharge to the modeled aquifer system within the basin; this simulated recharge is about 4,900 acre-feet for 1975. Simulation also indicates that lateral recharge from the southwest to the modeled system increased from zero (under predevelopment conditions) to about 1,450 acre-feet in 1975; lateral discharge from the basin, as simulated, was reduced to less than half the rate of 2,850 acre-feet per year under predevelopment conditions. Simulation to the year 2000, projecting a doubling of present-day pumping rates, indicates water-level decline of 30 to 35 feet below 1975 levels. A projection with pumping stabilized at 6,600 acre-feet per year indicates a decline of less than 10 feet below 1975 levels. (Woodard-USGS)
W80-02935

6B. Evaluation Process

COMPUTER-AIDED STREAM POLLUTION CONTROL AND MANAGEMENT, PART I,
New York State Dept. of Environmental Conservation, White Plains.
For primary bibliographic entry see Field 5G.
W80-02701

COMPUTER-AIDED STREAM POLLUTION CONTROL AND MANAGEMENT, PART II,
Stevens Inst. of Tech., Hoboken, NJ.
For primary bibliographic entry see Field 5G.
W80-02702

SOCIAL IMPACT STUDIES BELTON AND STILLHOUSE HOLLOW RESERVOIRS,
Texas Univ. at Austin. Dept. of Civil Engineering.
S. Chang, and L. R. Beard.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-133895, Price codes: A07 in paper copy, A01 in microfiche. Technical Report No CRWR-164, June 1979. 126 p, 30 Fig, 10 Tab, 3 Append. OWRT C-7680 (No 7255)(1).

Descriptors: *Social impact, *Texas, *Reservoirs, Economic impact, Employment, Recreation, Social values, Evaluation, Flood control, Human population, Environmental effects, Beaches, Public health, Transportation, Income, Benefits.

The social effects resulting from the implementation of reservoir water resources projects are examined. As examples, the social impacts resulting from the Belton and Stillhouse Hollow Reservoirs, Bell County, Texas, are documented and used to develop principles for evaluating projects in an integrated manner. Beneficial and adverse social effects are evaluated in the areas of: (1) personal effects, (2) community and institutional effects, (3) regional socio-economic effects, (4) national and emergency preparedness effects, and (5) aggregate social effects. Impact information was gathered from public data such as the U. S. census, from expert informants, and from personal interviews and questionnaires. Questionnaires and results from 11 land owner interviews are presented. Belton Dam, costing $13.8 million, was constructed by the U. S. Army Corps of Engineers beginning in 1949 and completed in 1954. The reservoir has 13.6 miles of shoreline and is 3 by 26 miles in area. Stillhouse dam was begun by the Corps in 1962 and completed in 1968. Its total cost was $20.1 million. The reservoir has 58 miles of shoreline. Overall impact analysis shows that social impacts are only occasionally related directly to economic effects and the most important impacts are those in the areas of health, welfare, and quality of living. Also, most of these impacts could be created in an alternative manner not involving reservoir construction. The quantitative value of social impacts should be limited by the cost of providing these alternative equivalent impacts. (Seigler-IPA)
W80-02710

WESTERN COAL PLANNING ASSISTANCE PROJECT: PHASE I, FINAL REPORT.
Western Coal Planning Assistance Project, Billings, MT.
Missouri River Basin Commission; Resource and Land Investigations Program (USGS), February 1979. 64 p, 4 Fig, 3 Tab, 7 Append.

Descriptors: *Coal mines, *Montana, *North Dakota, *Wyoming, *Future planning(Projected), Forecasting, Long-term planning, Missouri River, Evaluation, Land use, Energy, Environmental effects, Economic impact, Project planning, Comprehensive planning, Data collections.

In September 1977 Phase I of the Western Coal Planning Assistance Project (WCPAP) was begun to assist local planners in the major coal areas of Montana, North Dakota, and Wyoming. WCPAP was conducted by the Missouri River Basin Commission and the U.S. Geological Survey's Resource and Land Investigations Program. Objectives of Phase I of WCPAP were: (1) to determine the technical and information needs for assessment of coal development alternatives, (2) to develop the analytical tools and methods to respond to the various constraints encountered, and (3) to conduct workshops to help planners and decision makers. To meet these objectives WCPAP developed a Planning Reference System for State and local planners. The system consists of four documents: a fact book, a guide to impact assessment methods, a forecasts document, and a source book. Personal interviews, questionnaires, and workshop discussions were used for a planning and needs survey. Survey results are grouped into the following areas: technical assistance, training programs, information exchange, physical data, and social and economic data. The Planning and Reference System will need continual updating and supplementing to prevent it from becoming obsolete. The information in the system should be made available to planners throughout the Missouri River Basin and extensive training must be conducted to demonstrate the use and application of the methodologies and concepts in the system. (Seigler-IPA)
W80-02712

WESTERN COAL PLANNING ASSISTANCE PROJECT: FORECASTS FOR WESTERN COAL/ENERGY DEVELOPMENT.
ABT Associates, Inc., Englewood, CO.
Missouri River Basin Commission; Resource and Land Investigations Program (USGS), January 1979. 145 p, 11 Fig, 14 Tab, 46 Ref.

Descriptors: *Coal mines, *Montana, *North Dakota, *Wyoming, *Future planning(Projected), Long-term planning, Project planning, Projections, Land use, Comprehensive planning, Model studies, Forecasting, Evaluation, Time series analysis, Mathematical models, Sites, Energy.

Existing coal/energy forecasts are explained and compared as a part of the Planning Reference

System for planners and decision makers developed by the Western Coal Planning Assistance Project (WCPAP). WCPAP is designed to aid State and local planners and decision makers in the development of technical methods and information required to cope with coal-energy development problems. The project involves major coal areas in Montana, North Dakota, and Wyoming. A current problem for planners is that although many forecast methods have been developed, most are site-specific, yet vast differences are found from site to site in the WCPAP region. Also, there have been few guidelines for adapting site-specific information to other sites. As a result of these limitations existing coal/energy forecasts are infrequently used. While forecasts will not define the future they can provide a more specific method for anticipating future needs and the priorities that need to be established to meet those needs. Basically the groups of forecast methods include programming models, time series analysis, economic base or input-output related techniques, econometric models, and simulation methods. Existing coal/energy forecasts are evaluated in the areas of: (1) coal production forecasts, (2) study location, (3) data bases used, (4) economic relationship assumptions, (5) time frame, (6) technical change and capital availability assumptions, (7) Federal rules and regulations, and (8) State and local institutional factors. Guidelines are presented for the use of the various methods by planners and decision makers. (Seigler-IPA)
W80-02714

WESTERN COAL PLANNING ASSISTANCE PROJECT: A GUIDE TO METHODS FOR IMPACT ASSESSMENT OF WESTERN COAL/ ENERGY DEVELOPMENT.
Mountain West Research, Inc., Billings, MT.
Missouri River Basin Commission; Resource and Land Investigations Program (USGS), January 1979. 412 p, 14 Fig, 38 Tab, 96 Ref.

Descriptors: *Coal mines, *Montana, *North Dakota, *Wyoming, *Environmental effects, *Social aspects, Future planning(Projected), Economic impact, Land use, Data collections, Information exchange, Hydrogeology, Energy conversion, Geological surveys, Employment opportunities.

Methods for assessment of the impacts of western coal and energy development are identified and explained as a part of the Planning Reference System for planners and decision makers developed by the Western Coal Planning Assistance Project (WCPAP). WCPAP is designed to aid State and local planners and decision makers in the development of technical methods and information required to cope with coal-energy development problems. The project involves major coal areas in Montana, North Dakota, and Wyoming. An overview of the impact assessment process is followed by a guide to methods for assessing impacts on the human environment and on the natural environment. Human environment components include economic, demographic, facilities/services, land use, fiscal, social, and cultural. Natural environment components include soils, air, surface water, vegetation, wildlife, groundwater/geology, noise, and scenic/visual. In each component methods for impact projection are explained to assist planners. Some impact projection methods are explained in sufficient detail to allow the user to actually implement the technique. Of special value to planners is a definite method to estimate population changes caused by increased employment. A glossary of terms and an index are provided to give the user rapid access to the data and information in the planning reference system. (Seigler-IPA)
W80-02715

WESTERN COAL PLANNING ASSISTANCE PROJECT: FACT BOOK FOR WESTERN COAL/ENERGY DEVELOPMENT.
Mountain West Research, Inc. Billings, MT.
Missouri River Basin Commission; Resource and Land Investigations Program (USGS), January 1979. 560 p, 59 Fig, 39 Tab, 119 Ref.

Descriptors: *Coal mines, *Coals, *Montana, *North Dakota, *Wyoming, Data collections, Information exchange, Planning, Energy conversion, Environmental effects, Social aspects, Economic impact, Industrial water, Geological surveys, Transportation, Mining, Labor, Land use, Land management.

A wide range of coal-related facts are presented as part of the Planning Reference System for planners and decision makers developed by the Western Coal Planning Assistance Project (WCPAP). WCPAP is designed to aid State and local planners and decision makers in the development of technical methods and information required to cope with coal-energy development problems. The project involves major coal areas in Montana, North Dakota, and Wyoming. Coal related facts are presented in the areas of existing coal fields and mines, coal conversion including labor and water requirements, coal related facilities, transportation, legislation, and primary and secondary impacts such as environmental and socio-economic impacts. For each area a general perspective is presented followed by specific information relevant to the study area. Information is presented at an appropriate level of detail for local planners and decision makers, however, it is not highly technical. Fact sheets, charts, graphs, and tables are used to illustrate the data in each area. The book is designed to be a basic source information for those interested in coal resources and coal-related activities. (Seigler-IPA)
W80-02716

LIMNOLOGICAL AND SOCIOECONOMIC EVALUATION OF LAKE RESTORATION PROJECTS: APPROACHES AND PRELIMINARY RESULTS.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-100415, Price codes: A16 in paper copy, A01 in microfiche. Report No EPA-600/3-79-005, January 1979. Proceedings, Limnological and Socioeconomic Evaluation of Lake Restoration Projects, Corvallis, OR, February 28 - March 2, 1978. Compiled by Peterson, S. A., 350 p, 115 Fig, 48 Tab, 274 Ref.

Descriptors: *Lake restoration, *Lake stages, *Eutrophication, *Evaluation, Limnology, Social aspects, Economic impact, Phosphorus compounds, Nutrient removal, Plant growth, Dredging, Water pollution, Lakes, Model studies, Storm runoff, Lake sediments, Watersheds(Basins).

The Environmental Protection Agency's Clean Lakes Program was evaluated at a three day workshop. The workshop included those persons directly associated with the program in order to discuss the various evaluation techniques being used and the various decision making criteria on lake restoration projects. Nineteen papers were presented and the Lake Evaluation Index was discussed. Limnological, social, and economic aspects of some lakes were considered. Major objectives of the Clean Lakes Evaluation Program are (1) to determine the effectiveness of specific restoration techniques or combinations of techniques on specific lakes and (2) to compare the effectiveness of various restoration techniques on different lakes. Due to lack of sufficient funding it was necessary to evaluate the 314 lake restoration projects as subsets or groups in terms of treatment technique, watershed type, geographic distribution, and sociological setting. The common factor in all lake restoration projects is the goal of reducing phosphorus supply to the lakes. A final assessment program objective is to compile a handbook to assist decision makers in predicting the consequences of employing various restoration methods. (Seigler-IPA)
W80-02742

NATIONAL WATERWAYS STUDY,
Institute for Water Resources, Fort Belvoir, VA.
A. L. Dietz.
Water Spectrum, Vol 11, No 4, p 26-35, Fall 1979. 10 Fig.

Descriptors: *Channels, *Inland waterways, *Navigable waters, *Transportation, Grains(Crops), Energy, Dams, Locks, Flood control, Dredging, Harbors, Coastal engineering, Great Lakes, Bodies of water.

The U. S. Army Corps of Engineers is conducting a study to develop a comprehensive framework for the future of transportation on the nation's waterways. Key factors in the future of water transportation planning are: (1) basic freight movement capability, (2) safety and reliability, and (3) potential defense and emerging roles. The nation now has in use nearly 26,000 miles of commercially navigable waterways. Annually approximately 1.9 billion tons of freight are moved with foreign trade and domestic trade being nearly equal in volume. Of the total waterborne commerce in 1977, energy related products accounted for 61%. The second largest commodity transported was grain. The National Waterways Study's first step is the development of an inventory of the existing waterway system. The study is designed to develop alternative strategies to meet commercial navigation requirements and to correlate these strategies with municipal and industrial water needs, hydroelectric power generation, recreation needs, flood control, and other non-transportation uses. Strategies designed from study results will be useful in realizing an effective water transportation system through 2000. (Seigler-IPA)
W80-02749

SAGEBRUSH TO CROPLAND -- A WESTERN WATER PROJECT,
Idaho Univ., Moscow. Water Resources Research Inst.
J. Francis, and R. Schermerhorn.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-137565, Price codes: A03 in paper copy, A01 in microfiche. Report, March 1979. 30 p, 17 Fig, 2 Tab, OWRT C-6276 (5226) (1).

Descriptors: *Idaho, *Irrigation programs, *Project post-evaluation, Project benefits, Agriculture, Construction costs, Cost-benefit ratio, Irrigation water, Sprinkler irrigation, Irrigation effects, History, Economic impact, Environmental effects, Productivity.

The Boise Irrigation project begun in Idaho in the early 1900's now spreads water through 1800 miles of canals to 340,000 acres or 530 square miles. The project, one of the first large Bureau of Reclamation projects, was analyzed during the 1970s to determine its total impact and to develop methodologies to examine such projects. Lake Lowell, the first storage reservoir, was completed in 1908 and was followed by Arrowrock in 1915, Deadwood in 1931, Cascade in 1948, Anderson Ranch in 1950, and Lucky Peak in 1955. Benefits-costs ratios since 1910 show that prior 1941 return on output was low but from World War II until the present the benefit-cost ratio has been as high as 21.29 to 1 in 1947 and no lower than 4.85 to 1 in 1953. In 1973, the latest year calculated, the ratio was 9.94 to 1. Direct impacts of the project are seen in the farming of varied crops such as alfalfa, apples, wheat, prunes, onions, potatoes, barley, clover, corn, hops, lettuce, sugar beets, and mint. Three of the project's dams also have power generation facilities. Construction costs, charged to water users, have mostly been paid off. Some farmers still have to pay $0.75 per acre until 1991. Water costs are low with farmers in one area getting all the water they need for $14 per acre. Other benefits of the project include increased recreation activities and economic expansion. (Seigler-IPA)
W80-02772

FLORIDA'S WATER RESOURCES RESTORATION PROGRAM,
Florida State Dept. of Environmental Regulation, Tallahassee. Water Resources Restoration and Preservation.
A. J. Tolman.
In: Lake Restoration, Report No EPA 440/5-79-001, p 39-40, 1979.

Descriptors: *Florida, *Water management(Applied), Eutrophication, Lake stages, Coasts, Coastal marshes, Water quality control, Environmental effects, Government supports, Grants, Administration, Lakes, Bayous, Marshes, Urbanization, Sedimentation.

V 1 3 / 8 A P 1 5 8 0 UMI

The Florida Water Resources Restoration and Preservation Program (WRR and P), established in 1977, has completed three projects with 10 others in progress. Florida has 11,000 miles of coastline and approximately 7,000 lakes of at least 10 areas. Both areas of water resources are covered by the program. Program funding comes from general revenue from the State, Federal money from the Environmental Protection Agency's clean lakes program, and from the State pollution recovery fund. Major WRR and P employees are: an administrator, an administrative assistant, two secretaries, a limnologist, a marine biologist, a civil engineer, a field project director, and an attorney. In 1978, the WRR and P rule was adopted which sets the limitations of funding, the criteria for project selection, and the application form for use in applying for funds. Lake Apopka which is hypereutrophic will be aided by 50% funding from a section 314 Federal grant. The probable course of corrective action will be a drawdown which is currently being studied. Lake Jackson, suffering from heavy sedimentation and a general decline in water quality due to rapid urbanization, has also received Federal funding. Two large sedimentation basins are to be built along with a marsh biofiltration system. (See also W80-02773) (Seigler-IPA)
W80-02780

SOUTH DAKOTA'S LAKE PROGRAM,
South Dakota Dept. of Environmental Protection, Pierre.
J. R. Seyfer.
In: Lake Restoration, Report No EPA 440/5-79-001, p 43-45, 1979.

Descriptors: *South Dakota, *Water management(Applied), *Government supports, *Grants, Eutrophication, Lakes, Lake stages, Sediments, Sedimentation rates, Water quality control, Agriculture, Legislation, Recreation.

In 1975, South Dakota created the State Lake Preservation Committee to: (1) identify the eutrophication problems in the Prairie Coteau, a region of glacial lakes; (2) inventory and classify Coteau lakes from existing data; (3) develop lake prioritizing criteria for preservation and restoration; and (4) assure adequate agency authority for the implementation of restoration projects. A lake protection and rehabilitation grant program was established in 1978 to provide the needed project funding. South Dakota has approximately 800 publicaly owned lakes of which 90% have been designated eutrophic by the Department of Environmental Protection. Land runoff of sediment and agricultural chemicals is the major cause of eutrophication. To combat this particular problem a special requirement for funding is the approval of the project by the affected conservation district and the identification of both point and nonpoint water pollution sources. Proposed projects are rated by a point system that takes into account lake surface area, depth, fisheries classification, public accessibility, population, and other criteria. A public hearing must be held for each project and State and Federal funding percentage requirements must be met. The 208 Water Quality Management Plan is also active in South Dakota. Through the 208 plan, a Model Implementation Program was awarded for Lake Herman. Project funding will come from a wide variety of agencies and will be used to provide the best management practices possible. Dredging, lakeshore riprapping, and placement of sediment control structures are planned. (See also W80-02773) (Seigler-IPA)
W80-02782

VERMONT LAKES AND PONDS PROGRAM,
Vermont Dept. of Water Resources, Montpelier.
J. W. Morse.
In: Lake Restoration, Report No EPA 440/5-79-001, p 47-50, 1979. 1 Ref.

Descriptors: *Vermont, *Water management(Applied), Lakes, Lake stages, Eutrophication, Water quality control, Recreation, Freshwater, Planning, Administration, Phosphorus, Dissolved oxygen, Monitoring, Chlorophyll.

To assure recreation potential, monitor trophic status, and develop restoration projects where needed for its 527 freshwater lakes, Vermont has established a Lakes and Ponds Program. The program is divided into three phases. The first phase, Lakes and Ponds Surveillance, monitors water quality to identify lakes that may have problems. Each year 30 to 35 lakes are sampled and results are distributed publically in the form of summary sheets. In phase two, Lakes and Ponds Studies, the results from selected phase one lakes receive documentation and a more intensive study is conducted using water quality data, historical information, and predictive models. From this study, public lake reports are prepared that satisfy the U.S. Environmental Protection Agency's New England requirement for background information and the Vermont's Aquatic Nuisance Control Program requirement for a biological survey. In phase three, Management and Restorative Action, lake management and restorative programs are developed, initiated, and administered for a limited number of problem lakes. Additional satellite lake programs are: a Phosphorus/Chlorophyll Modeling Program, a Hypolimnetic Dissolved Oxygen Program, a Lay Monitoring Program, and a Lake and Pond Inventory Program. (See also W80-02773) (Seigler-IPA)
W80-02783

INTEGRATION OF ASSISTANCE PROGRAMS TO ACHIEVE WATER QUALITY STANDARDS,
Environmental Protection Agency, Washington, DC.
L. J. Guarraia.
In: Lake Restoration, Report No EPA 440/5-79-001, p 55-57, 1979.

Descriptors: *Government supports, *Water management(Applied), *Governmental interrelations, Water quality control, Lakes, Planning, Grants, Legislation, Agriculture, Governments, Sewage effluents, State governments, Water quality act.

Water quality standards are set by each state based on the desired use of a body of water. From these standards a state can then determine the water quality criteria necessary to meet the standards. Once the standards and criteria have been determined, appropriate steps must be taken to protect the body of water for its selected use. Possible steps include preventing runoff from the watershed, control of wastes from industry and agriculture, and control of sewage treatment plant wastes. The Environmental Protection Agency's clean lakes program is designed to help states with setting water quality standards, determining the needed criteria, and the necessary steps. Also, the program provides funding to help states carry out the necessary steps such as to control of nonpoint source pollution in watersheds and the correction of in-lake pollution problems. Other programs, agencies, and services that can be integrated with the clean lakes program include: the 208 water quality management program; the National Pollutant Discharge Elimination System (NPDES) permits program; the 201 construction grants program; the Agriculture Soil and Conservation Services; the Community Development Block Grant program; the Appalachian Commission; the Land and Water Conservation Fund; the Agriculture Stabilization and Conservation Service; the Energy, Environment, and Natural Resources Program; and the Land and Water Conservation Fund. (See also W80-02773) (Seigler-IPA)
W80-02785

THE FUTURE OF THE CLEAN LAKES PROGRAM,
Environmental Protection Agency, Washington, DC. Criteria and Standards Div.
K. M. Mackenthun.
In: Lake Restoration, Report No EPA 440/5-79-001, p 59-62, 1979. 7 Ref.

Descriptors: *Federal Water Pollution Control Act, *Government supports, *Water quality control, Legislation, Grants, State governments, Lakes, Lake stages, Monitoring, Management, Administration, Planning, Water pollution, Waste water(Pollution), Water pollution control.

States such as Wisconsin and Minnesota began taking actions to improve their lakes early in the 1900s and were rapidly followed by numerous other states. The Federal government became involved in 1972 with the enactment of the Federal Water Pollution Control Act. In 1975, Federal financial support became available to states for their water quality programs. Since then $36.3 million have been appropriated for this purpose. Actual project costs are approximately twice this amount since Federal support represents only about 50% of the total funding. Federal funding through the Environmental Protection Agency's clean lakes program has been used to support water quality restoration projects in 73 lakes in 23 states. The program is primarily directed toward the control of nonpoint pollutants and the implementation of methods to hasten lake recovery after the control of the pollutants. In 1978 EPA made funds available to states to inventory the extent and nature of eutrophication in significant lakes and to support feasibility studies for those methods most suited to restore lake water quality. EPA is currently developing regulations for the future management of the clean lakes program. Increased EPA/State agreements should make the program more effective. Future program focus will deal strongly with the impacts of nonpoint source pollutants and on the methods, management planning, and implementation of best management practices to correct the pollution sources. (See also W80-02773) (Seigler-IPA)
W80-02786

EPA'S LAKE RESTORATION EVALUATION PROGRAM,
Corvallis Environmental Research Lab., OR.
S. A. Peterson.
In: Lake Restoration, Report No EPA 440/5-79-001, p 187-193, 1979. 1 Fig, 4 Tab, 15 Ref, 1 Append.

Descriptors: *Eutrophication, *Water management(Applied), *Water pollution, *Evaluation, Treatment, Lakes, Lake stages, Social aspects, Economic impact, Nutrients, Phosphorus, Dissolved oxygen, Secchi disks, Limnology, Chlorophyll, Nitrogen.

The overall effectiveness of the Environmental Protection Agency's lake restoration program is being assessed. The 60 lakes in the program as of September 1975 were grouped into similar types according to restoration techniques used. The three groups are: (1) source controls, (2) in-lake controls, and (3) problem treatment (directed at biological consequences of lake condition). Representative projects were selected and are being evaluated for each group. The lakes are evaluated limnologically, sociologically, and economically through the use of research grants. Mass balance modeling of nutrients, especially phosphorus is used as an evaluation tool. A lake evaluation index that includes Secchi depth, dissolved oxygen, phosphorus, chlorphyll a, and nitrogen compounds is also used. The attitudes of lake uses concerning lake restoration are used in the socioeconomic evaluations. As a product of the lake restoration evaluation program a water quality manager's handbook will be compiled to help managers optimize the recreational potential of lake restoration. (See also W80-02773) (Seigler-IPA)
W80-02801

MONITORING OF HYDRAULIC DREDGING FOR LAKE RESTORATION,
Union College, Schenectady, NY. Dept. of Civil Engineering
P. D. Snow, R. P. Mason, C. J. George, and P. L. Tobiessen.
In: Lake Restoration, Report No EPA 440/5-79-001, p 195-204, 1979. 10 Fig, 4 Tab, 6 Ref.

Descriptors: *Dredging, *Lake sediments, *Runoff, Bottom sediments, New York, Water pollution effects, Nutrients, Lakes, Lake stages, Phosphorus, Settling basins, Aquatic plants, Pondweeds, Secchi disks, Dissolved oxygen, Environmental effects, Phytoplankton, Zooplankton.

The dredging restoration program for Collins Lake, an oxbow lake of the Mohawk River in

Scotia, New York, is being monitored to determine its impact. The lake is a recreational asset to the area and is used for swimming, boating, and fishing. Water pollution from runoff and nutrients stored in bottom sediments in shallow areas is causing lake deterioration. Overwhelming populations of water chestnut and curly-leaved pondweed have occurred. Outbreaks of Pediastrum simplex are also a problem. Restoration plans include the removal of 100,000 cu cm of accumulated organic matter by means of a hydraulic dredge developed by Mud Cat Division, National Car Rental, Inc. Dredging began in 1977 with the dredged material being pumped into a decanting or settling lagoon. Thus far approximately 40,000 cu cm have been removed. Physical, chemical, and biological parameters are being monitored at four lake stations twice a month. Monitored parameters include conductivity, dissolved oxygen, soluble orthophosphate, total phosphorus, alkalinity, acidity, pH, hardness, temperature, Secchi disk depth, numbers and kinds of plankton, and other parameters. It is too soon to make definite conclusions about the success or failure of the ongoing dredging restoration project. (See also W80-02773) (Seigler-IPA)
W80-02802

ENVIRONMENTAL QUALITY AND RESIDUALS MANAGEMENT,
Resources for the Future, Washington, DC.
A. V. Kneese, and B. T. Bower.
Johns Hopkins University Press, Baltimore and London, 1979. 338 p, 47 Tab, 29 Fig, Append.

Descriptors: *Residuals, *Residuals management, *Models, *Social aspects, *Mathematical models, *Delaware Valley, *Water quality, *Environmental quality, Management, Pollution, Resource allocation, Political aspects, Water quality, Lower Delaware Valley, Industrial plants, Industrial wastes, Industries, Linear programming.

The useful and practical ways to apply residuals management techniques on national, state and local community levels are analyzed. Residuals problems are seen as not being dealt with adequately by the free market system because of failure to account for the value of 'common property resources' such as air, land and water. Basic thrusts of the research program were (1) micro and regional analyses, (2) collective choice theory, and (3) basic economic theory and macroanalyses. Integrated residuals management at the micro (i.e. plant) level and technologies and costs of integrated residuals management are presented. The most important type of regional analysis was the building of a quantitative regional residuals-environmental quality management (REQM) model, intended for the analysis of alternative policies for residuals management; relationships among costs, environmental quality levels and type of management strategy; and distribution of costs and benefits. The formal structure of the model is described, followed by an extended theoretical discussion of its political and institutional aspects. The model was applied to the Lower Delaware Valley region; an aquatic ecosystem model of the Delaware Estuary was also developed. The model showed substantial variation in both air and water quality in the region. Ambient water quality standards in the estuary can be met by using various combinations of methods. Regional alternatives would be more economical than residuals discharge reduction at individual sites. A macro model of residuals discharges and discharge reduction costs is presented; and, finally, it is suggested that national accounting measures incorporate residuals management costs in industrial, governmental and consumer expenditures. (Arnold-NC)
W80-02846

ENERGY PRODUCTION AND WATER RESOURCES IN THE COLORADO RIVER BASIN,
Los Alamos Scientific lab., NM.
For primary bibliographic entry see Field 6D.
W80-02859

AN OVERVIEW OF RIVER-BASIN ASSESSMENT TECHNIQUES IN AN ENERGY-IMPACTED REGION--YAMPA RIVER BASIN, COLORADO AND WYOMING,
Geological Survey, Lakewood, CO.
For primary bibliographic entry see Field 6A.
W80-02865

SOCIAL ASSESSMENT AND RESOURCE POLICY: LESSONS FROM WATER PLANNING,
Michigan Univ., Ann Arbor. School of Natural Resources.
G. A. Daneke, and J. D. Priscoli.
Natural Resources Journal, Vol 19, No 2, p 359-375, April 1979. 1 Fig.

Descriptors: *Policy, *Social assessment, *Social aspects, *Decision making, *Water resources planning, *Water resources development, *Planning, Social impact, Social values, Economics, Management, Cost-benefit ratio, Water resources, Assessment, Analysis, Water, Benefits, Public benefits.

Water resource development agencies have advanced the state-of-the-art in social well-being and quality of life accounting systems. As social and environmental assessments become widely utilized, the importance of presently held distinctions between land, air and water planning, as well as natural vs. built systems, will diminish. Various forms of social accounting have emerged as alternatives to traditional resource assessment strategies. Social assessments can identify a range of value concerns not often expressed in the standard economic account. A variety of distinct life-quality accounting methodologies have also emerged. Some of the more widely used techniques are: (1) social profiling, (2) institutional analysis, (3) community assessment, (4) construction impact analysis, (5) mitigation design, and (6) survey research. However, there is no guarantee that the results of life-quality accounts will be given full weight in the decision-making process; some contend that they are too amorphous and subjective to warrant practical acceptability. These social indicators expand understanding of the distribution of costs and benefits. Social information will earn public confidence if it is used to display and help adjudicate conflicting claims, to design socially useful projects and programs which produce minimal social disruptions, and to explore means of enhancing the general quality of life. (Iervolino-NC)
W80-02868

LAKE REHABILITATION: A STATUS REPORT,
Wisconsin Univ., Madison. Dept. of Urban and Regional Planning.
For primary bibliographic entry see Field 2H.
W80-02869

PLAN FOR DEVELOPMENT OF THE LAND AND WATER RESOURCES OF THE SOUTHEAST RIVER BASINS: SAVANNAH BASIN, APPENDIX 1.
1963. 212 p, 117 illustrations, 48 Tab.

Descriptors: *Water resources development, *Water policy, *River basin development, *Comprehensive planning, *Management, *Savannah River, Water resources, Administration, Legislation, Natural resources, Multiple-purpose projects, Project purposes, Social aspects, Programs, Coordination, Navigation, Water supply, Recreation, Flood control, Irrigation, Land resources, Hydroelectric power, Soil conservation, Fish management, Wildlife management, Salinity, Sediment control, Water pollution, Hurricanes, Beach erosion.

This appendix summarizes studies made in formulating a comprehensive plan for the development of water and related land resources of the Savannah River Basin. Part One sets the stage for development. The basin area, its resources, people and economy are described. Part Two outlines needs and opportunities. Problems reviewed are flood control and prevention, water supply, navigation, reclamation, irrigation and drainage, hydroelectric power and industrial development, soil conservation and use, fish and wildlife, recreation, salinity and sediment control, pollution abatement and public health, beach erosion control and hurricane protection. Part Three describes planning procedures as applied to this study. Objectives and guidelines are outlined, planning assumptions and criteria presented and plan formulation evaluated. Part Four discusses the comprehensive basin plan. The impacts of the plan on all the factors listed above are assessed. More general economic and physical impacts are studied. Plan implementation suggestions are presented, followed by recommendations for specific projects and programs. The last part studies the possibility of local, state and federal participation and assistance. (Zayac-NC)
W80-02877

PRELIMINARY REPORT: WATER SYSTEM IMPROVEMENTS, CITY OF LEWISBURG, WEST VIRGINIA.
Martin (Deward M.), and Associates, Inc., Beckley, WV.
For primary bibliographic entry see Field 6D.
W80-02878

THE ECONOMIC EFFECTS OF WEATHER MODIFICATION ACTIVITIES, PART I -- CROP PRODUCTION IN THE BIG SPRING-SNYDER AREA,
Texas Dept. of Water Resources, Austin.
W. Allaway, L. Lippke, R. Riggio, and C. Tuck.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-112048, Price codes: A04 in paper copy, A01 in microfiche. Report No WR-1, November, 1975. 59 p, 4 Fig, 5 Tab, 14 Ref, 2 Append.

Descriptors: *Weather modification, *Texas, *Rainfall, *Crop production, Cotton, Grain sorghum, Wheat, Agriculture, Input-Output analysis, Economic impact, Regression analysis, Precipitation(Atmospheric), Farms, Crops, HIPLEX.

As a part of the High Plains Cooperative Program (HIPLEX) agricultural production in 14 counties of the Big Spring-Synder area of Texas was studied to estimate the value of additional crop yields and the economic effects resulting from hypothetically-induced increases in rainfall. Crop production and harvested acreage in each county were obtained from the Texas Crop and Livestock Reporting Service for cotton, grain sorghum, and wheat. Multiple regression analysis was used to estimate crop yield increases due to increased rainfall from weather modification. These estimates of yield increases were then converted to monetary values for use in an input-output model to provide economic activity estimates resulting from the increased crop revenues. Overall results show that substantial direct increases would occur in agricultural incomes with the proposed increases in precipitation. Rainfall increases prior to crop planting or during the growing season would result in the greatest crop responses. For cotton and grain sorghum this would be January through March and June through August, however, increased precipitation during harvesting would be harmful. The greatest economic benefits from increased rainfall in a single month would be seen for March with a 10% increase in rainfall producing $323,000 in increased revenues. Total region effects (income, employment, and spending) for a 10% March rainfall increase would be approximately $500,000. (See also W80-02995) (Seigler-IPA)
W80-02994

THE ECONOMIC EFFECTS OF WEATHER MODIFICATION ACTIVITIES, PART II -- RANGE PRODUCTION AND INTERINDUSTRY ANALYSIS,
Texas Dept. of Water Resources, Austin.
L. Lippke.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-112055, Price codes: A05 in paper copy, A01 in microfiche. Report No WR-2, August 1976. 89 p, 7 Fig, 14 Tab, 33 Ref, 3 Append.

Descriptors: *Weather modification, *Texas, *Rainfall, *Range management, *Forage grasses, Forages, Livestock, Economic impact, Precipitation(Atmospheric), Regression analysis,

Browse utilization, Rain, Water shortage, HIPLEX.

As a part of the High Plains Cooperative Program (HIPLEX) range production in 14 counties of the Big Spring-Synder area of Texas was studied to determine the direct income and total economic effects resulting from hypothetically-induced increases in rainfall. Precipitation in the area varies from 14 to 22 inches annually. Forage yield of the rangeland has a direct bearing on the output and costs of the livestock industry. Multiple linear regression with rainfall and range conditions from 1941 through 1971 was used to estimate the change in range forage production due to increased rainfall from weather modification. A method based on an estimate of the additional number of animal units months of grazing resulting from the improved range conditions was used to convert these estimates to monetary values. Major study results are: (1) rainfall during the spring months is very important to the condition of the range for the remainder of the year; (2) previous year range condition has a significant impact on current range condition; and (3) a 10% rainfall increase during the month of April (0.16 in) would result in an income increase of $299,100. Interindustry analysis results show that a 10% rainfall increase in March would produce an increase in overall regional production of $455,000. Total output benefits in the area resulting from a 10% increase in March rainfall are about $1.7 million while total income would increase by $984,000. (See also W80-02994) (Seigler-IPA)
W80-02995

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

FRESH WATER EXPORT BY OIL TANKERS,
California State Univ., Chico. Dept. of Civil Engineering.
M. Mow.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-134422, Price codes: A03 in paper copy, A01 in microfiche. Land and Water Resources Institute, University of Maine, Orono. Completion Report, October 1979. 27 p, 6 Fig, 4 Tab, 9 Ref, 1 Append, OWRT A-043-ME (2).

Descriptors: *Freshwater, *Ships, *Oil, *Arid lands, *Export, Foreign trade, Import, Harbors, Deep water, Atlantic Ocean, Gulf of Mexico, Northeast U.S., Pipes, Model studies, Economics, Cost repayment, Very large crude carriers, Water utilization, Oil pollution, Water pollution sources.

An economic model was developed to study the potential for fresh water export to arid oil exporting nations by returning oil tankers. Currently Very Large Crude Carriers (VLCC) are ballasted with salt water for their return trip, however, most tanker ports in the U.S. are located in 'water excess' zones such as the Gulf Coast and the North Atlantic states giving easy access to fresh water loading. Costs associated with water export are those for pipes, right-of-ways, intake towers, and water treatment facilities. The model estimates the capital expenditure necessary for a water export facility and the water rate (dollars/1000 gallons) required to liquidate that capital. The model has six components that are described in detail. Results of a North Atlantic deep water port example are given to illustrate the model with non-site-specific conditions being estimated. It is concluded that fresh water export to the Middle East could be economically feasible if deep water ports that are developed have nearby adequate fresh water supplies and fresh water contamination by cargo tank residues can be prevented. Also the export of fresh water in tankers instead of a salt water ballast would eliminate water pollution caused by dumping of the ballast in the ocean. (Seigler-IPA)
W80-02769

CURRENT ISSUES IN U.S. ENVIRONMENTAL POLICY.
For primary bibliographic entry see Field 6E.
W80-02847

6D. Water Demand

INCREASING WATER AND SEWER RATE SCHEDULES: A TOOL FOR CONSERVATION,
Washington Suburban Sanitary Commission, Hyattsville, MD.
For primary bibliographic entry see Field 3D.
W80-02857

ENERGY PRODUCTION AND WATER RESOURCES IN THE COLORADO RIVER BASIN,
Los Alamos Scientific lab., NM.
D. Abbey.
Natural Resources Journal, Vol 19, No 2, p 275-314, April 1979. 5 Fig, 13 Tab.

Descriptors: *Colorado River Basin, *Energy production, *Water allocation(Policy), *River basin development, *Water consumption(Plants), *Water use, Water resources, Water utilization, Energy, Colorado, Water depletion, Water supplies, Energy industry, Water policy, Electricity, Electric power, Electric power costs.

Since 1962, over 10,000 megawatts (MW) of coal-fired electric generating capacity have been installed in the Colorado Basin, with an additional 19,000 MW under construction or planned. Energy development poses a host of water-related problems, the most fundamental being adequacy of freshwater supplies. Besides energy production, water must be allocated for instream uses such as recreation, aesthetics, and fish and wildlife. The intent of this paper is to demonstrate the applicability of the substitution process to water use in the energy industry, and to provide some insight into patterns of future water use and potential for water conservation in energy production. Discussion of water demand at a coal-fired plant focuses on factors that influence the level of process and plant consumption and the incremental costs of reducing consumption or using a lower quality water supply. Four principal processes comprise the water utilization system of a coal-fired electric generating plant; the greatest potential for reducing consumption is substitution of air or dry cooling for wet or evaporative cooling. Availability and cost of alternative water supplies in the Basin are discussed including surface water, reallocation of water, and groundwater. Water system elements for new electric plants projected to come on-line are presented and the influence of water use costs on electricity prices are discussed. The author concludes that no compelling justification for controlling water use of the energy industry is provided, and that if such controls are to be justified, they must come from a quantitative examination of the value of water to all users, not just the energy industry. He contends that the impact of energy development on allocation of water resources in the Basin has been overrated and misrepresented. (Iervolino-NC)
W80-02859

AN OVERVIEW OF RIVER-BASIN ASSESSMENT TECHNIQUES IN AN ENERGY-IMPACTED REGION--YAMPA RIVER BASIN, COLORADO AND WYOMING,
Geological Survey, Lakewood, CO.
For primary bibliographic entry see Field 6A.
W80-02865

PRELIMINARY REPORT: WATER SYSTEM IMPROVEMENTS, CITY OF LEWISBURG, WEST VIRGINIA.
Martin (Deward M.), and Associates, Inc., Beckley, WV.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 601, Price codes: A12 in paper copy, A01 in microfiche. Economic Development Administration Technical Assistance Project, Department of Commerce. Prepared for City of Lewisburg, West Virginia, April 1977. 158 p, 9 Plates, 3 Maps, 8 Tab, 4 Fig, 3 Append, 01-6-01446.

Descriptors: *Lewisburg(WV), *West Virginia, *Water supply development, *Economics, *Feasibility studies, *Planning, *Project planning, *Distribution systems, Water supply, Water treatment, Water distribution(Applied), Water delivery, Financing, Water works, Water demand, Administration, Costs.

The City of Lewisburg owns and operates the only public water supply in a large populated area of Greenbrier County, WV, serving approximately 7,000 people. It is totally inadequate to provide proper domestic service and fire protection to present customers. Recent improvements helped alleviate some emergency conditions which existed but did not eliminate the gross deficiencies in the system. Population is expected to increase from 4,706 in 1977 to 5,640 by 1990, with an increase in the Lewisburg water system from 7,980 to 9,680 by 1995. City water records indicate an average water use of approximately 430,000 gallons per day (gpd) and a peak daily use in excess of 700,000 gpd. By 1995 the waterworks should have a capacity for an average daily use of .968 mgd and a peak daily use of 1.45 mgd. Based on studies of the supply, treatment and distribution systems and financial analyses, it was recommended that construction of new waterworks facilities be divided into three phases. Phase I would include a new water supply intake structure, an additional filter at the current water plant, a new high level transmission system, and storage on both the high and low level systems. The Phase II project would include construction of new strengthening mains for fire protection in both Lewisburg and Fairlea. Phase III would include a new water treatment plant, a second major water supply transmission main, and major distribution system improvements in the northern part of the service area. Water distribution mains in the Caldwell area should be included. Total cost for the proposed project improvements is $6,511,600. The city would be eligible to apply for federal funds through four different agencies. (Iervolino-NC)
W80-02878

6E. Water Law and Institutions

STATUS REPORT ON COMPLIANCE WITH THE CHLOR-ALKALI MERCURY REGULATIONS 1976-77.
Environmental Protection Service, Ottawa (Ontario). Water Pollution Control Directorate.
Available from Environmental Protection Service, Department of the Environment, Ottawa, Ontario, Canada, K1A 1C8. Economic and Technical Review Report EPS 3-WP-79-8, October 1979, English and French, 14 p, 3 Fig, 3 App.

Descriptors: *Regulation, *Mercury, *Effluents, Industrial wastes, Measurement, Efficiencies, Compliance, Comparative studies, Canada.

This report reviews the results of the measures taken by industry and government agencies to curtail mercury losses in liquid effluents from chlor-alkali plants in Canada. A similar status report was issued for the year 1975. Mercury losses in liquid effluents have been reduced by over 99 percent since 1970. Plant records and regulatory monitoring by both federal and provincial environmental control agencies have confirmed this reduction. The drastic reduction in mercury purchases and consumption since 1970 is the result of the installation of efficient treatment systems, and increased recovery of mercury from waste gases and solids; seven plants have also terminated production or converted from the mercury to the diaphragm cell process. (WATDOC)
W80-02835

STATUS REPORT ON ABATEMENT OF WATER POLLUTION FROM THE CANADIAN PETROLEUM REFINING INDUSTRY - 1977.
Environmental Protection Service, Ottawa (Ontario). Water Pollution Control Directorate.
Available from Environmental Protection Service, Environment Canada, Ottawa, Ontario, Canada K1A 1C8. Economic and Technical Review Report EPS 3-WP-79-5, July 1979, English and French, 39 p, 7 Fig, 6 Tab.

Descriptors: *Industrial wastes, *Pollutants, *Oil, Compliance, Industrial plants, Regulation, Storm water, Toxicity, Analytical techniques.

Effluent regulations and guidelines to limit the discharge of pollutants from the Canadian petroleum refining industry were issued under the Federal Fisheries Act in 1973. This report presents an assessment of the progress made to the end of 1977 in meeting the discharge objectives, and provides projections of the anticipated status by 1980. (WATDOC)
W80-02836

ENVIRONMENTAL QUALITY AND RESIDUALS MANAGEMENT,
Resources for the Future, Washington, DC.
For primary bibliographic entry see Field 6B.
W80-02846

CURRENT ISSUES IN U.S. ENVIRONMENTAL POLICY.
Published for Resources for the Future, Washington, DC., by Johns Hopkins University Press, Baltimore, 1978. P. R. Portney, editor. 207 p.

Descriptors: *Air pollution, *Water pollution, *Environmental control, *Environmental effects, *Environmental policy, *Policy, *Clean Air Act, *Water Pollution Control Act, *Economic impacts, *Pollution abatement, Legislation, Cost-Benefit analysis, Cost allocation, Water policy, Governments, Institutional constraints, Environmental quality, Models, Macroeconometric models, Air pollution effects, Emissions control.

Existing federal policies regulating air and water pollution and exposure to toxic substances are discussed and analyzed. One emerging problem is potential conflict between the desirability of having clear and specific statements of objectives from Congress and the need for the administrative agencies to be flexible in dealing with individual cases under changing conditions. Such legislation as the Clean Air Act Amendments do not include a system for weighting of the costs of achieving standards against anticipated favorable effects, and threshold pollutant levels for the public are set without adequately considering evidence that subthreshold levels of some pollutants are deleterious. Under the Water Pollution Control Act Amendments the goal of 'zero discharge' may not be either feasible or desirable and could entail far more costly technology than originally envisioned. Mandatory installation of certain technologies without consideration first of costs and benefits does not make economic sense and could weaken incentives for firms to make innovations in pollution control technology. The federal subsidy program for waste treatment plants encourages communities to choose treatment facilities with high capital costs relative to operating and maintenance costs. Benefits and costs should be carefully balanced. Market-like incentives for pollution abatement are recommended. Automotive air pollution problems are discussed and recommendations are made for emissions criteria. The Toxic Substances Act and other legislation relating to toxic and hazardous substances are reviewed and alternatives for control are considered. U.S. environmental policy is evaluated in relation to the national economy. Recommendations include better coordination and information collection. (Arnold-NC)
W80-02847

MODELS FOR WATER RESOURCES DECISION-MAKING: PROBLEMS AND PROJECTS,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
For primary bibliographic entry see Field 6A.
W80-02860

A RATIONAL APPROACH TO WATER QUALITY CONTROL,
Birmingham Univ. (England). Dept. of Civil Engineering.
T. H. Y. Tebbutt.
Water Supply and Management, Vol 3, No 1, p 41-53, 1979. 7 Ref, 8 Fig, 2 Tab.

Descriptors: *Water pollution control, *Water quality control, *Rational formula, *Pollution abatement, *Water pollution, *Water quality, Mathematical models, Effluents, Environmental control, Biochemical oxygen demand, Pollutants, Water resources, River flow, Water quality standards.

Water technologists have a responsibility to the community for the expenditure of public money and they have a duty to resist the adoption of costly and complex water quality control measures. The control of water pollution should be based on consideration of the nature and volume of the discharge, available dilution in the receiving water, downstream water usage and, in the case of non-conservative pollutants, the self-purification characteristics of the system. It is reasonable therefore to decide upon the quality required in a particular water course and then to control discharges to the water to ensure that the desired quality is maintained. When formulating water quality control measures in a receiving water the value of river discharge selected for the establishment of effluent standards is of considerable significance. A more basic examination of water quality control measures can be made if arbitrary standards on receiving water quality are abandoned and the system is operated on the basis of an optimizing model. Mathematical models should be produced which describe all the natural and man-made factors which operate in the system together with the associated costs and benefits. Rational least cost approach to water quality control can be helpful in preventing at least some of the excesses of current environmental legislation. (Iervolino-NC)
W80-02861

NORTH AMERICAN WATER TRANSFERS: AN OVERVIEW,
Biswas and Associates, Ottawa (Ontario).
A. K. Biswas.
Water Supply & Management, Vol 2, No 2, p 79-90, 1978. 1 Fig, 2 Tab, 20 Ref.

Descriptors: *Water transfer, *Imported water, *Interbasin transfers, *North American Water and Power Alliance(NAWAPA), *Water resources, *Water demand, Water supply, Legal aspects, Technical aspects, Socio-economic aspects, Political aspects, Environmental aspects, Water utilization, Water development, Water supply development.

A water transfer may be defined as an interbasin diversion--the artificial withdrawal of water by ditch, canal or pipeline from its source in one contributing or exporting drainage basin for use in another receiving or importing basin. Before water transfers can be considered three factors must be analyzed: assessments of available water resources, the nature of the demand function, and the efficiency of water use. Urban centers account for most of the long distance water importations. Several current interbasin diversions are discussed. The most ambitious of the proposed interregional transfers is the North American Water and Power Alliance (NAWAPA) first proposed in 1964. The general idea of the $100 billion project is to collect surplus water from the high precipitation areas of the northwestern part of the North American continent and distribute it to water-scarce areas of Canada, the U.S. and northern Mexico. A series of dams and power stations in Alaska and northern British Columbia would collect water and provide power to pump this water up to the Rocky Mountain Trench Reservoir in southeastern British Columbia. From there the water would be lifted by pumps to the Sawtooth Reservoir in central Idaho, from which it would flow by gravity to the western States. Problems associated with such large transfers fall into four separate headings: technical, socio-economic, political and legal, and environmental. These constraints result in the unlikelihood that such large scale water transfer schemes will be implemented within the foreseeable future in the United States. (Iervolino-NC)
W80-02870

COMPREHENSIVE WATER AND RELATED LAND RESOURCES INVESTIGATION, CONNECTICUT RIVER BASIN. VOLUME I: MAIN REPORT.
New England River Basins Commission, Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A043 894, Price codes: A17 in paper copy, A01 in microfiche. June 1970. 394 p, 20 Fig, 40 Tab, 1 Plate.

Descriptors: *Connecticut River, *Water resources development, *River basin development, *Comprehensive planning, Administration, Conservation, Federal government, Governments, Legislation, Natural resources, Multiple-purpose projects, Social aspects, Water policy, Water resources, Population, Economics, Land resources, Physiographic provinces, Water resources.

This report is the result of a six-year comprehensive investigation of the 11,250 square mile Connecticut River Basin together with a Plan of Development of the water and related land resources. Short- and long-term resource needs are identified and a plan is presented for the best uses of these resources. Programs and projects recommended for initiation in the next 10-15 years are included, and potential measures to meet the basin's needs to the year 2020 are identified. This Main Report is drawn from 19 separate appendices and is divided into a summary and 11 chapters, with each chapter divided into three parts. Part One first surveys the background legislation and related water law and policy. The basin is described in a general sense; a chapter on physiography presents the basin's land form. Part Two looks at the basin's population, both present and projected, and studies the economy in light of these figures. Needs and problems of the basin are discussed, followed by a chapter exploring various devices or options available to meet needs. A chapter on alternative plans follows, with alternatives ranked on both cost- and social-effectiveness bases. Part Three presents the coordinated basin plans, the 1980 Early Action Plan and the 2020 Long Range Plan. The economic impacts are discussed as well as the priorities which must be met to keep open the options allowing for wise growth and maintenance of environmental quality. Methods of scheduling and implementing the plan are suggested. Participant views are then presented, followed by recommendations for Congress. (Zayac-NC)
W80-02874

COMPREHENSIVE WATER AND RELATED LAND RESOURCES INVESTIGATION, CONNECTICUT RIVER BASIN, VOLUME VII: APPENDICES--K: PLAN FORMULATION; L: NAVIGATION.
New England River Basin Commission, Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A043 895, Price codes: A18 in paper copy, A01 in microfiche. June 1970. 400 p.

Descriptors: *Connecticut River, *Water resources development, *Comprehensive planning, *River basin development, *River basins, Connecticut, Massachusetts, Long-term planning, Short-term planning, Coordination, Administration, Estimated benefits, Estimated costs, Institutions, Legislation, Management, Methodology, Social aspects, Navigable rivers, Recreation, Boating, Water supply, Flood control, Anadromous fish, Wildlife, Public health.

This Volume VII is part of a 6-year comprehensive investigation of the Connecticut River Basin together with a Plan of Development of the water and related land resources. Appendix K deals with Plan Formulation. The planning environment is first assessed as planning authority, guiding documents and study controls are discussed. The present environment is inventoried. Basin water resources, the natural environment, historical and cultural development, and economic development are reviewed. Factors of change are deliberated in a chapter that outlines social and demographic trends, economic trends, technological changes and urbanization. Needs of the future are evaluated in each of the following areas: power, recreation, environmental preservation, fisheries, wildlife,

water supply, navigation, land management, solid waste disposal, public health, estuaries, flood control and flow regulation and augmentation. Elements of the basin plan are identified, along with its objectives, goals and short- and long-term perspectives. Benefits and costs are summarized and alternatives for substantive areas suggested. Appendix L is divided into four sections. The first reviews improvements both in commercial and recreational navigation on the Connecticut River from Long Island Sound to Hartford. Section II assays recreational and commercial navigation on the river from Hartford to Holyoke, MA. Section III discusses recreational boating on the main stem and the federal permit program on the river above Holyoke. The final section reviews canoeing possibilities, both existing and prospective, on tributary streams. (Zayac-NC)
W80-02875

PLAN FOR DEVELOPMENT OF THE LAND AND WATER RESOURCES OF THE SOUTHEAST RIVER BASINS: SAVANNAH BASIN, APPENDIX 1.
For primary bibliographic entry see Field 6B.
W80-02877

WATER ALLOCATION AND MANAGEMENT IN THE SOUTHEAST,
North Carolina State Univ. at Raleigh; and North Carolina Univ. at Chapel Hill.
For primary bibliographic entry see Field 4A.
W80-02917

6F. Nonstructural Alternatives

MANAGING STORM RUNOFF IN CHICAGO AREA,
Metropolitan Sanitary District of Greater Chicago, IL.
For primary bibliographic entry see Field 5G.
W80-02914

6G. Ecologic Impact Of Water Development

CULTURAL RESOURCE INVENTORY OF AREAS AFFECTED BY REJECT STREAM REPLACEMENT PROJECTS,
Westec Services, Inc., San Diego, CA.
W. T. Eckhardt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-301 335, Price codes: A07 in paper copy, A01 in microfiche. Prepared for the U.S. Department of Interior, Bureau of Reclamation, July 1979. 158 p, 35 Fig, 8 Tab, 125 Ref, 8 Append. 8-07-30-V0041.

Descriptors: *California, *Surveys, *Desalination plants, *Archaeology, Resources, History, Planning, Dating, Vegetation, Deserts, Brines, Environmental effects, Project planning, Data collections, Cultural resources.

Approximately 14,990 acres of East Mesa and Imperial Valley, California, were culturally inventoried in compliance with Federal regulations for areas affected by Federal projects. The Yuma Desalting Plant in Arizona, a Federal project, will reject approximately 42,000 ac-ft of brine per year which it is required to replace with fresh water from other sources. Four alternative sources are: (1) lining a section of the All-American canal, (2) desalting Alamo River Water, (3) desalting geothermal fluid, and (4) extracting groundwater. The alternatives are evaluated by the areas and cultural resources affected. From the field survey 95 cultural resource sites were identified. Three archaeological sites and two districts were nominated for inclusion to the National Register of Historic Places. Recommended mitigation measures for the protection of these historic sites include restricted public knowledge of exact site location, careful construction of roads and other areas so that archaeological sites are avoided, and subsequent archaeological clearance before future development. Also, if it is impossible to design alternative construction to avoid archaeological sites, they must be salvaged prior to any project activity and a reasonable amount of time must be allowed for this. The inventory is designed to be a systematic base for future planning and cultural resource management. (Seigler-IPA)
W80-02738

LAKE REHABILITATION: A STATUS REPORT,
Wisconsin Univ., Madison. Dept. of Urban and Regional Planning.
For primary bibliographic entry see Field 2H.
W80-02869

COMPREHENSIVE WATER AND RELATED LAND RESOURCES INVESTIGATION, CONNECTICUT RIVER BASIN. VOLUME I: MAIN REPORT.
New England River Basins Commission, Boston, MA.
For primary bibliographic entry see Field 6E.
W80-02874

COMPREHENSIVE WATER AND RELATED LAND RESOURCES INVESTIGATION, CONNECTICUT RIVER BASIN, VOLUME VII: APPENDICES--K: PLAN FORMULATION; L: NAVIGATION.
New England River Basin Commission, Boston, MA.
For primary bibliographic entry see Field 6E.
W80-02875

PLAN FOR DEVELOPMENT OF THE LAND AND WATER RESOURCES OF THE SOUTHEAST RIVER BASINS: SAVANNAH BASIN, APPENDIX 1.
For primary bibliographic entry see Field 6B.
W80-02877

AN ARCHAEOLOGICAL OVERVIEW OF THE MIDDLE AND LOWER SANTA CRUZ BASIN,
Arizona State Museum, Tucson.
D. A. Westfall.
Archaeological Series No 134, P.O. No 0-01-32-04430, June 1979. Prepared for the Arizona Projects Officer, Bureau of Reclamation. 109 p, 10 Fig, 4 Tab, 151 Ref.

Descriptors: *Arizona, *Archaeology, *History, *Vegetation, *Environmental effects, Deserts, Land use, Aqueducts, Water conveyance, Human population, Cacti, Desert plants, Arid lands.

The cultural resource base in parts of Pinal and Pima counties, Arizona, was evaluated to determine the effects of various construction alternatives for the proposed Tucson Aqueduct, a part of the Central Arizona Project. The 1550 square miles of the study area are divided into zones according to vegetation communities: (1) mesquite-saltbush, (2) mixed paloverde-cacti, (3) desert riparian, (4) creosotebush-bursage, (5) desert grassland, (6) upper elevation oak wooded-chaparral pine and spruce, and (7) modern agricultural, urban, roads, and transmission lines. Within the area a variety of prehistoric sites occur including villages, agricultural/horticultural systems, base camps, food gathering/processing sites, hunting/butchering sites, rockshelters, trails, and petroglyphs. A prediction model of cultural resource sensitivity was developed for preliminary planning purposes. For Reach 1, the northern project area, the creosotebush-bursage zone has the lowest number of sinificant sites and the desert riparian zone has the most significant sites. Of the various alternatives, Route I is expected to have the greatest cultural resource impact and Route III the smallest impact. For Reach 2, the southern project area, significant resources are located in all zones and all alternatives are likely to effect significant resources in all zones, however, Route V is the most favorable alternative since it is located away from the Tucson Basin. (Seigler-IPA)
W80-03000

7. RESOURCES DATA

7A. Network Design

DATA NEEDS FOR DISASTER POLICY MAKING,
Wharton School, Philadelphia, PA.
L. Miller, J. Vinso, and H. Kunreuther.
In: Natural Hazards Data Resources: Uses and Needs; Program on Technology Environment and Man, Monograph 27; Institute of Behavioral Science, Colorado University p 81-97, 1979. 2 Fig, 1 Tab.

Descriptors: *Data collections, *Information exchange, *Disasters, Political aspects, Research and development, Planning, Economics, Cost-benefit analysis, Surveys, Data processing, Census, Statistics, Basic data collections.

Data which are accessible, timely, and disaggregate are needed for the development of meaningful policies on the needs of hazard-prone and disaster-stricken areas. Such policy making involves cost and benefit analyses on many dimensions. A framework for data processing in policy making showing the interactive roles of the different groups involved in data generation and information production is presented. Raw data are collected by agencies and researchers. Researchers and special interest groups formulate and test various hypotheses. Staffs and lobbyists evaluate trade-offs and analyze costs and benefits. Governmental policy makers, Federal, State and local, make the actual policy selections. The policies are then interpreted and administered. Experience from policy administration then generates more raw data and the cycle begins again. In order for the data to be valuable to various users it must be organized. Natural hazard information is organized into three stages: (1) initial specification of the risk area; (2) specification of a disaster and its immediate physical, financial, and personal impacts prior to recovering; and (3) recovery and mitigation measure impacts. A table of user and disaster data for different groups is provided and data source agencies are recommended, source agencies included The Red Cross, The Small Business Administration, The Farmer Home Administration, The Corps of Engineers, and the Federal Insurance Administration. (Seigler-IPA)
W80-02808

7B. Data Acquisition

GEOPHYSICAL STUDIES OF THE HYDRAULIC PROPERTIES OF GLACIAL AQUIFERS IN THE PAWCATUCK RIVER BASIN, R.I.,
Rhode Island Univ., Kingston. Dept. of Geology.
R. K. Frohlich.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-134703, Price codes: A03 in paper copy, A01 in microfiche. Rhode Island Water Resources Center, University of Rhode Island. Project Report, November 1979. 38 p, 19 Fig, 10 Ref, OWRT A-068-RI (1).

Descriptors: *Rhode Island, *Hydrogeology, *Groundwater basins, *Aquifers, Aquifer systems, Geohydrologic units, Glaciohydrology, Seismic studies, Gravity, Depth, Drilling, Aquifer characteristics, Groundwater, Water sources, Refractivity.

The potential of geophysical methods for groundwater exploration was studied in the Upper and Lower Wood River area of southern Rhode Island. In the area a complexity of aquifers is associated with glacial stream channels, however, only some of the aquifers are sufficiently large for groundwater use. To locate and classify these aquifers three geophysical techniques were used: a gravity survey, geophysical depth sounding, and seismic refractivity profiles. Fifteen gravity profiles were taken across the area in an east-west direction with a La Costa and Romberg, Model G, gravimeter and the Bouguer anomaly was obtained by subtracting normal gravity from observed gravity. Seven geoelectrical depth soundings were conducted and sounding curves are presented. Layer

velocities, thicknesses, and depth to bedrock were studied with twenty-one reserved seismic refraction profiles. None of these methods alone can identify optimal aquifer locations therefore it is recommended that all three be used to reduce or more efficiently organize exploratory drilling. Figures are presented illustrating results for each of the geophysical methods including Bouguer anomaly, gravity profiles, transmissivity maps, depth sounding curves, seismic refraction profiles, and velocity-depth profiles. (Seigler-IPA)
W80-02770

NUMERICAL COMPUTATION OF AVALANCHE MOTION,
Department of the Environment, Calgary (Alberta).
T. T. Cheng, and R. Perla.
Available from Inland Waters Directorate, Environment Canada, Ottawa, Ontario, Canada KLA 0E9. NHRI Paper No 5, 1979. 12 p, 1 Tab, 2 Fig, 3 Ref.

Descriptors: *Avalanches, *Computer models, Snow, Velocity, Probability, Path.

A computer program named ACCEL has been designed to process avalanche path data. Given path geometry, friction coefficients and dynamic parameters, ACCEL computes avalanche speeds at selected positions along the path and prints out the position at which the avalanche stops. This publication gives a complete set of instructions on how to use ACCEL. A brief description of the basic theories and methods employed in the program are given. The input-output data and formats are described in detail with examples. A program listing and flowchart are also included. (WATDOC)
W80-02845

RECOMMENDED METHODS FOR WATER DATA ACQUISITION--A FEDERAL/NON-FEDERAL ACTIVITY TO DEVELOP STANDARD METHODOLOGY,
Geological Survey, Reston, VA. Water Resources Div.
A. I. Johnson, G. L. Knapp, and F. P. Kapinos.
In: Proceedings of the 4th Joint Conference on Sensing of Environmental Pollutants, held in New Orleans, Louisiana, November 6-11, 1977: American Chemical Society, p 351-353, 1978. 1 Fig.

Descriptors: *Data collections, *Methodology, *Surface waters, *Groundwater, *Water quality, Water sampling, Water analysis, Water yield, Sedimentation, Measurement, Networks, Documentation, Reviews, *Data collections handbook.

To coordinate data collection activities, the U.S. Geological Survey's Office of Water Data Coordination (OWDC) is publishing the 'National Handbook of Recommended Methods for Water-Data Acquisition.' Prepared by OWDC with the help of advisory committees and working groups from both Federal and non-Federal organizations, the 'National Handbook' recommends methods for acquiring data on surface water, ground water, chemical and biological water quality, sediment, soil moisture, drainage-basin characteristics, evaporation and transpiration, snow and ice, and hydrometeorology. The Coordinating Council, which consists of representatives from 18 Federal agencies, and a working group of the Advisory Committee on Water Data for Public Use, which consists of representatives of non-Federal organizations, provide policy guidance. The Coordinating Council was designated as the Federal Metric Panel for Hydrology and is responsible for recommending (1) metric units, (2) precision of metric measurement, and (3) metric conversion of equipment. The 'National Handbook' will emphasize use of the SI metric system. (Woodard-USGS)
W80-02933

A SUPPLEMENT TO--METHODS FOR COLLECTION AND ANALYSIS OF AQUATIC BIOLOGICAL AND MICROBIOLOGICAL SAMPLES (U.S. GEOLOGICAL SURVEY TECHNIQUES OF WATER-RESOURCES INVESTIGATIONS, BOOK 5, CHAPTER A4),
Geological Survey, Reston, VA. Water Resources Div.
Geological Survey open-file report 79-1279, August 1979. 92 p, 1 Tab, 84 Ref. Greeson, P. E., editor.

Descriptors: *Analytical techniques, *Water sampling, *Water analysis, *Aquatic populations, Biological communities, Microbiology, Methodology, Enteric bacteric, Biomass, Chlorophyll, Diatoms, Periphyton, Phytoplankton, *Sample preservation.

The manual contains methods used by the U.S. Geological Survey to collect, preserve, and analyze waters to determine their biological and microbiological properties. It supplements 'Methods for Collection and Analysis of Aquatic Biological and Microbiological Samples' (TWRI, Book 5, Chapter A4, 1977, edited by P. E. Greeson, T. A. Ehlke, G. A. Irwin, B. W. Lium, and K. V. Slack). Included are 5 new methods, a new section of selected taxonomic references for Ostracoda, and 6 revised methods. (Woodard-USGS)
W80-02936

7C. Evaluation, Processing and Publication

METHODS OF COMPARING ANNUAL RAINFALL RECORDS FOR CLIMATIC PURPOSES,
University of East Anglia, Norwich (England). Climatic Research Unit.
For primary bibliographic entry see Field 2B.
W80-02867

GROUND-WATER RESOURCES AND MODEL APPLICATIONS FOR THE EDWARDS (BALCONES FAULT ZONE) AQUIFER IN THE SAN ANTONIO REGION, TEXAS,
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 2F.
W80-02883

WATER RESOURCES DATA FOR UTAH, WATER YEAR 1978.
Geological Survey, Salt Lake City, UT. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-119621, Price codes: A21 in paper copy, A01 in microfiche. Geological Survey Water-Data Report UT-78-1, August 1979. 492 p, 7 Fig.

Descriptors: *Utah, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for Utah consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of ground water. This report contains discharge records for 255 gaging stations; stage and contents for 21 lakes and reservoirs; water quality for 34 hydrologic stations, 186 partial-record stations, and 275 wells; and water levels for observation wells. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Utah. (Woodard-USGS)
W80-02924

WATER RESOURCES DATA FOR MICHIGAN, WATER YEAR 1978.
Geological Survey, Lansing, MI. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-117013, Price codes: A20 in paper copy, A01 in microfiche. Geological Survey Water-Data Report MI-78-1, July 1979. 451 p, 9 Fig.

Descriptors: *Michigan, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for Michigan consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water temperature of ground water. This report contains discharge records for 187 gaging stations, stage only records for 1 gaging station, stage and contents for 5 lakes and reservoirs, water quality for 65 continuous-record stations and 6 lakes, and water levels for 45 observation wells. Also included are 93 crest-stage partial-record stations and 18 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal Agencies in Michigan. (Woodard-USGS)
W80-02925

WATER RESOURCES DATA FOR IOWA, WATER YEAR 1978.
Geological Survey, Iowa City, IA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116676, Price codes: A12 in paper copy, A01 in microfiche. Geological Survey Water-Data Report IA-78-1, July 1979. 256 p, 6 Fig.

Descriptors: *Iowa, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for Iowa consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels in wells. This report contains discharge records for 118 gaging stations, stage and contents for 5 lakes and reservoirs, water quality for 22 gaging stations, and water levels for 32 observation wells. Also included are 124 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements and analyses. The data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Iowa. (Woodard-USGS)
W80-02926

WATER RESOURCES DATA FOR CONNECTICUT, WATER YEAR 1978.
Geological Survey, Hartford, CT. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-117583, Price codes: A16 in paper copy, A01 in microfiche. Geological Survey Water-Data Report CT-78-1, June 1979. 363 p, 4 Fig.

Descriptors: *Connecticut, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for Connecticut consist of records of stage, discharge, and water quality of streams; stage, contents and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This report contains records for water discharge at 52 gaging stations; tidal volume for 1 gaging station; stage only records for 3 tidal-gaging stations; contents for 36 lakes and reservoirs; water quality for 52 gaging stations, 6 lakes and reservoirs, 62

wells, 1 spring, and 1 chemical precipitation station; and water levels for 21 observation wells. Also included are 41 crest-stage and 34 low-flow partial-record stations. Additional water data were collected at various sites not part of the systematic data-collection program and are published as miscellaneous measurements and analyses. A few pertinent stations (not included above) in bordering States are also included in this report. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Connecticut. (Woodard-USGS)
W80-02927

WATER RESOURCES INVENTORY OF CONNECTICUT, PART 8, QUINNIPIAC RIVER BASIN,
Geological Survey, Hartford, CT. Water Resources Div.
D. L. Mazzaferro, E. H. Handman, and M. P. Thomas.
Connecticut Water Resources Bulletin No 27, 1978. 88 p, 56 Fig, 5 Plates, 36 Tab, 149 Ref.

Descriptors: *Connecticut, *Water resources, *Surface waters, *Groundwater resources, *Water quality, Reviews, Projects, Hydrologic data, Water utilization, Water demand, Available water, Hydrology, Water analysis, Chemical analysis, Streamflow, Runoff, Floods, Aquifer characteristics, Model studies, Data collections, Evaluation, *Quinnipiac River basin(Conn).

The 363 square mile Quinnipiac River basin area received an average of 47 inches of precipitation during the 1931-60 period; runoff and evapotranspiration averaged 26 and 21 inches respectively. The 90-percent duration flow of the Quinnipiac River at its mouth exceeds 50 Mgal/d (million gallons per day). Yields of 64 screened wells tapping stratified drift range from 17 to 2,000 gal/min (gallons per minute); the median yield is 500 gal/min. Long-term yields estimated for 14 favorable areas of stratified drift range from 0.8 to 16.1 Mgal/d. Wells in till generally yield a few hundred gallons of water daily. Water in bedrock supply modest amounts of water throughout the area; median yields range from 7 to 10 gal/min. Surface-water samples collected at 20 sites in the area had median dissolved-solids concentrations of 117 mg/L (milligrams per liter) at high flow and 146 mg/L at low flow. Ground-water samples from 130 wells had a median dissolved-solids concentration of 188 mg/L. High concentrations of iron, manganese, and hardness, and saltwater intrusion cause water-quality problems in parts of the area. In 1970, freshwater use was estimated at 35,710 million gallons. (Woodard-USGS).
W80-02930

8. ENGINEERING WORKS

8A. Structures

NATIONAL HYDROELECTRIC POWER RESOURCES STUDY, PRELIMINARY INVENTORY OF HYDROPOWER RESOURCES, VOLUME 1: PACIFIC NORTHWEST REGION,
Institute for Water Resources (Army)., Fort Belvoir, VA.
W. R. Sigleo, J. R. Hanchey, and D. G. Nolton.
Vol 1 of 6, July 1979. 242 p, 4 Fig, 6 Tab, 3 Append.

Descriptors: *Hydroelectric power, *Hydroelectric plants, *Dams, *Pacific Northwest U.S., Electric power, Washington, Oregon, Idaho, Alaska, Energy, Reservoirs, Damsites, Surveys, Electric generators, Powerplants.

Potentially feasible hydropower resources from both existing dams and undeveloped sites were preliminarily inventoried for the Pacific Northwest states of Washington, Oregon, Idaho, and Alaska. This area has the largest portion of the nation's installed capacity and generates 48% of the country's hydroelectric total. Estimates of total potential for the region exceed 327,000 MW of which 26,800 MW have been installed. Another 33,300 MW could be produced by upgrading and expanding existing plants while the capacity for new installations is 267,500 MW. Of the installed capacity, most are large units with small units accounting for only 2% of the total. Tables are presented giving capacities for the six national regions (Pacific Northwest, Pacific Southwest, Mid-Continent, Lake Central, Southeast, and Northeast). Tables of state-by-state estimates for all existing, incremental, and developed sites in the Pacific Northwest are also provided. The tables include project name, river name, owner, location, drainage area, and various capacity values. Basic data on existing facilities taken from the Corps' National Inventory of Dams which lists approximately 50,000 dams. (Seigler-IPA)
W80-02718

NATIONAL HYDROELECTRIC POWER RESOURCES STUDY, PRELIMINARY INVENTORY OF HYDROPOWER RESOURCES, VOLUME 2: PACIFIC SOUTHWEST REGION,
Institute for Water Resources (Army), Fort Belvoir, VA.
W. R. Sigleo, J. R. Hanchey, and D. G. Nolton.
Vol 2 of 6, July 1979. 136 p, 4 Fig, 7 Tab, 3 Append.

Descriptors: *Hydroelectric power, *Hydroelectric plants, *Dams, *Southwest U.S., Electric power, Hawaii, California, Nevada, Utah, Arizona, Energy, Reservoirs, Damsites, Surveys, Electric generators, Powerplants.

National potentially feasible hydropower resources from both existing dams and undeveloped sites were preliminarily inventoried and the results are presented for the Pacific Southwest states of Arizona, California, Hawaii, Nevada, and Utah. This area has approximately 6% of the total potential capacity for the United States. Of the 33,000 MW of potential capacity only 9,900 MW have been installed. Another 6,000 MW could be realized by upgrading and expanding existing projects. Less than 4% of the total installed capacity is produced by small-scale facilities. Tables are presented giving capacities for the six national regions (Pacific Northwest, Pacific Southwest, Mid-Continent, Lake Central, Southeast, and Northeast). Tables of state-by-state estimates for all existing, incremental, and developed sites in the Pacific Southwest are also provided. The tables include project name, river name, owner, location, drainage area, and various capacity values. Basic data on existing facilities were taken from the Corp's National Inventory of Dams which lists approximately 50,000 dams. (Seigler-IPA)
W80-02719

NATIONAL HYDROELECTRIC POWER RESOURCES STUDY, PRELIMINARY INVENTORY OF HYDROPOWER RESOURCES, VOLUME 3: MID-CONTINENT REGION,
Institute for Water Resources (Army), Fort Belvoir, VA.
W. R. Sigleo, J. R. Hanchey, and D. G. Nolton.
Vol 3 of 6, July 1979. 247 p, 4 Fig, 12 Tab, 3 Append.

Descriptors: *Hydroelectric power, *Hydroelectric plants, *Dams, Montana, Wyoming, Colorado, New Mexico, Texas, Oklahoma, Kansas, Nebraska, South Dakota, North Dakota, Energy, Reservoirs, Damsites, Surveys, Electric generators, Powerplants.

National potentially feasible hydropower resources from both existing dams and undeveloped sites were preliminarily inventoried and results are presented for the Mid-Continent states of Montana, Wyoming, Colorado, New Mexico, Texas, Oklahoma, Kansas, Nebraska, South Dakota, and North Dakota. For the area, a maximum potential of 44,000 MW represents approximately 9% of the nation's total potential. Of the total estimated capacity for the area, only 6,500 MW have been installed. By upgrading and expanding existing facilities another 7,800 MW could be realized leaving a potential 29,900 MW undeveloped. Less than 3% of the total installed capacity is in the form of small-scale facilities. Colorado, Texas, and Montana have the largest potential for incremental development. Tables are presented giving capacities for all six national regions. Tables of state-by-state estimates for all existing, incremental, and developed sites in the Mid-Continent region are also provided. The tables include project name, river name, owner, location, drainage area, and various capacity values. Basic data on existing facilities were taken from the Corps' National Inventory of Dams which lists approximately 50,000 dams. (Seigler-IPA)
W80-02720

NATIONAL HYDROELECTRIC POWER RESOURCES STUDY, PRELIMINARY INVENTORY OF HYDROPOWER RESOURCES, VOLUME 4: LAKE CENTRAL REGION,
Institute for Water Resources (Army), Fort Belvoir, VA.
W. R. Sigleo, J. R. Hanchey, and D. G. Nolton.
Vol 4 of 6, July 1979. 214 p, 4 Fig, 11 Tab, 3 Append.

Descriptors: *Hydroelectric power, *Hydroelectric plants, *Dams, Minnesota, Iowa, Missouri, Illinois, Wisconsin, Michigan, Indiana, Kentucky, Ohio, Energy, Reservoirs, Damsites, Surveys, Electric generators, Powerplants.

National potentially feasible hydropower resources from both existing dams and undeveloped sites were preliminarily inventoried and results are presented for the Lake Central states of Minnesota, Iowa, Missouri, Wisconsin, Illinois, Kentucky, Indiana, Michigan, and Ohio. The estimated 26,000 MW of potential energy in the area represents approximately 5% of the nation's total. In the area 2,600 MW have been installed. By expanding and upgrading existing facilities another 15,800 MW could be realized. Installing powerplants at the remaining potentially feasible sites would produce an additional 7,800 MW. The region has a large percentage (24%) of small-scale plants especially in Michigan and Wisconsin. Tables are presented giving capacities for all six national regions (Pacific Northwest, Pacific Southwest, Mid-Continent, Lake Central, Southeast, and Northeast). Tables of state-by-state estimates for all existing, incremental, and developed sites in the Lake Central region are also provided. The tables include project name, owner, location, drainage area, and various capacity values. Basic data on existing facilities were taken from the Corps' National Inventory of Dams which lists approximately 50,000 dams. (Seigler-IPA)
W80-02721

NATIONAL HYDROELECTRIC POWER RESOURCES STUDY, PRELIMINARY INVENTORY OF HYDROPOWER RESOURCES, VOLUME 5: SOUTHEAST REGION,
Institute for Water Resources (Army), Fort Belvoir, VA.
W. R. Sigleo, J. R. Hanchey, and D. G. Nolton.
Vol 5 of 6, July 1979. 194 p, 4 Fig, 12 Tab, 3 Append.

Descriptors: *Hydroelectric power, *Hydroelectric plants, *Dams, Arkansas, Louisiana, Mississippi, Alabama, Georgia, Tennessee, Virginia, North Carolina, South Carolina, Florida.

National potentially feasible hydropower resources from both existing dams and undeveloped sites were preliminarily inventoried and results are presented for the Southeast states of Arkansas, Louisiana, Mississippi, Alabama, Tennessee, Georgia, Florida, South Carolina, North Carolina, and Virginia. The inventory shows that the maximum physical potential for all sites in the Southeast region is approximately 48,000 MW. This amount represents about 9% of the national total. Of the potential inventoried only 11,800 MW have been installed. By upgrading and expanding existing facilities another 13,000 MW could be produced. Installation of new facilities at the remaining useful undeveloped sites would produce another 23,200 MW. Approximately 2% of the regions facilities are small scale -- mostly located in North Carolina and South Carolina. Tables are presented giving capacities for all six national regions. Tables of

state-by-state estimates for all existing, incremental, and developed sites in the Southeast region are given. The tables include project name, owner, location, drainage area, and various capacity values. Basic data on existing facilities were taken from the Corps' National Inventory of Dams which lists approximately 50,000 dams. (Seigler-IPA)
W80-02722

NATIONAL HYDROELECTRIC POWER RESOURCES STUDY, PRELIMINARY INVENTORY OF HYDROPOWER RESOURCES, VOLUME 6: NORTHEAST REGION,
Institute for Water Resources (Army), Fort Belvoir, VA.
W. R. Sigleo, J. R. Hanchey, and D. G. Nolton.
Vol 6 of 6, July 1979. 314 p, 4 Fig, 14 Tab, 3 Append.

Descriptors: *Hydroelectric power, *Hydroelectric plants, *Dams, Connecticut, Delaware, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, West Virginia.

National potentially feasible hydropower resources from both existing dams and undeveloped sites were preliminarily inventoried and results are presented for the Northeast states of Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Delaware, New Jersey, New York, Pennsylvania, Rhode Island, and West Virginia. Although undeveloped hydropower potential data was not available for six of the states, it is estimated that the region has a potential of 33,000 MW. This amount represents about 11% of the nation's total potential. Only 6,100 MW of the regions potential has been installed. Upgrading and expanding existing facilities could result in an additional 18,700 MW. Development of the other potential sites would produce 8,500 MW. The states with the highest potential for incremental development are New York, Maine, and New Hampshire. Tables are presented giving capacities for all six national regions. Also, tables of state-by-state estimates for all existing, incremental, and developed sites in the Southeast region are given. The tables include project name, owner, location, drainage area, and various capacity values. Basic data on existing facilities were taken from the Corps' National Inventory of Dams which lists approximately 50,000 dams. (Seigler-IPA)
W80-02723

DERELICTION OF ASSETS,
North West Water Authority, Warrington (England).
J. Lloyd.
Water, No 28, p 48-50, September 1979. 1 Fig.

Descriptors: *United Kingdom, *Sewage districts, *Water delivery, Waste water disposal, Sewage disposal, Sewage, Pipes, Storm drains, Combined sewers, Urbanization, Storm water, Maintenance costs, Replacement costs.

After 50 years of neglect the North West Water Authority, United Kingdom, has adopted a policy of orderly maintenance, renewal, and replacement for its underground water system assets. Much of the currently used system is quite old, some dating to the industrial revolution of the late 18th century. Underground facilities tend to be neglected because they are out of sight, are initially expensive, and are expected to have a long service life. The North West Water Authority has widespread evidence of dilapidation such as frequent sewer collapses and burst water mains, storm sewer overflows, flooding of roads and houses, dirty water from encrusted mains, and varying water supply and pressure. The Authority's underground assets to be maintained include 36,000 Km of water mains and 30,000 Km of sewers. Improved arrangements for regular maintenance and renewals have been made. It is expected that water rates will be increased to allow for repairs of the underground system. Organizational and staff requirements are also being considered. A vigorous public campaign has been mounted to prepare the public for increased rates and expenditures. Recent large sewer collapses in Manchester have helped to make the public aware of the problem. (Seigler - IPA)
W80-02756

PLANNING MAINTENANCE,
Lothian Region Council, Edinburgh (Scotland).
L. Freeman.
Water, No 28, p 52-53, September 1979. 1 Fig.

Descriptors: *United Kingdom, *Sewage districts, *Sewage disposal, Sewerage, Pipes, Urbanization, Maintenance costs, Replacement costs, Public utilities, Public benefits.

Harry O'Hanlon, deputy director of drainage for the Lothian Regional Council feels that the sewer system in Edinburgh, Scotland, is not in danger of collapse. There is currently much concern for the condition of sewer systems in the United Kingdom due to their age and lack of prior comprehensive maintenance programs. Edinburgh recently installed a new sewage disposal system and stopped discharging untreated sewage into the Firth of Forth. This year the city plans to conduct an inspection and maintenance program for its 100 miles of trunk sewers. Ten men forming two teams will work mainly at night to do minor repairs and to report larger problems for contract repair. For two years the city has been conducting an inspection of it smaller sewers by television. Overall it is believed that the sewer system is in good repair although some trouble spots are likely. O'Hanlon believes that the public scare about decaying sewers is unwarranted. (Seigler - IPA)
W80-02757

8B. Hydraulics

ADEQUACY OF DATA RESOURCES FOR THE NEEDS OF THE CONSULTING ENGINEER TO LOCAL GOVERNMENT,
Wright Water Engineers, Inc., Denver, CO.
K. R. Wright, P. D. Binney, and M. M. Stokes.
In: Natural Hazards Data Resources: Uses and Needs; Program on Technology, Environment and Man, Monograph 27; Institute of Behavioral Science, Colorado University, p 44-53, 1979.

Descriptors: *Flood data, *Flood damage, *Engineering personnel, *Data collections, Hydrologic data, On-site data collections, Hazards, Floodproofing, Warning systems, Flood forecasting, Building codes, Flood protection, Runoff, Urbanization, Mapping.

Consulting engineers are often used by local governments for hazard research especially in the costly area of flooding. Engineers develop design criteria, conduct original research, and assist in the development of building coeds. They help reduce flood damage by improving drainage and control structures, by refining warning systems and floodproofing techniques, and by improving or extending forecasting. Consulting engineers must rely largely on data resources that in many cases are not adequate or site specific. Data needed include hydrologic data, mapping, flood-frequency reliability, runoff, urbanization, stage-damage frequency relationships, urban storm drainage, and control structure hydraulics. Consulting engineers can also participate in hazard data dissemination, disaster planning, and in nonstructural methods of flood management. Nonstructural methods include floodproofing and flood warning. The consulting engineer also needs to work actively with other professionals such as political and social scientists and economists in the reduction of flood losses. (Seigler-IPA)
W80-02806

8C. Hydraulic Machinery

AN ELECTRIC CONVERSION FOR MECHANICAL-HYDRAULIC GOVERNORS OF WATER WHEEL TURBINES,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
C. L. Clemans, L. E. Eilts, and F. R. Schleif.
Available from the National Technical Information Service, Springfield, VA 22161. Report No REC-ERC-79-16, December 1979. 48 p, 26 Fig, 4 Ref, 3 Append.

Descriptors: *Governors, *Mechanical equipment, *Hydraulic turbines, Hydraulic equipment, Control systems, Mechanical control, Testing procedures, Power system operation, Electronic equipment, Stability, Velocity, Coordination, Performance, Research and development.

Conventional mechanical-hydraulic governors can be up-graded by a simple conversion system to improve sensitivity, linearity, and speed response to small speed deviations without degrading stability of speed control. All of this can be accomplished simply without extensive expense, outage of time or sacrifice of ruggedness or high reliability. The conversion upgrades governor systems from temporary-droop type to a high order double-derivative type by replacing the dashpot function with derivative terms from an independent frequency sensor. A velocity feedback system around the valves and servomotor simplify the gate response function and aid in gate timing adjustment. Installation is simple and control can be transferred instantly since all original mechanical apparatus is retained for startup and standby. The apparatus is schematically described in detail with information on tests and alinement of electrical governors and mechanical governors by simulated isolation and trouble shooting aids. (Seigler-IPA)
W80-02717

WATER FLOW-DEFLECTING SHIELD FOR DREDGE SUCTION NOZZLE,
Deepsea Ventures, Inc., Gloucester Point, VA. (Assignee).
R. M. Donaldson, T. W. Christian, and G. E. Miller.
U.S. Patent No 4,171,581, 6 p, 4 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 987, No 4, p 799, October 23, 1979.

Descriptors: *Patents, *Dredging, Exploration, *Oceans, Flow control, Hydrodynamics, Nozzles, Intakes, Hydraulic equipment, Suction dredges, Deep-sea mining.

The object of the invention is to provide means to improve the effectiveness of a dredge head in removing nodules and other ore of a like particulate nature from the ocean floor. The dredge head comprising a suction nozzle having a nozzle inlet located adjacent the bottom of the nozzle is operatively connected to water-deflecting means, located forward of the nozzle and is designed to defelct water flowing towards the nozzle downward towards the nozzle opening. The nozzle opening is facing in a generally forward, and most preferably obliquely downward direction. The combination of the effect of the downwardly deflected water and of the obliquely opening nozzle improves the ability of the nozzle to recover particulate material along its path. In a preferred embodiment, the nozzle presents a vertically elongated surface facing forward towards the free-stream flow of water and is pivotally connected to the vehicle. (Sinha - OEIS)
W80-02897

8D. Soil Mechanics

A COMPARISON OF ELECTRONIC AND PIPET METHODS FOR MECHANICAL ANALYSIS OF SOILS,
Idaho Univ., Moscow. Dept. of Plant and Soil Sciences.
K. L. Pennington, and G. C. Lewis.
Soil Science, Vol 128, No 5, p 280-284, November 1979. 3 Fig, 1 Tab, 10 Ref.

Descriptors: *Soil analysis, *Laboratory tests, *Testing procedures, *Particle size, Testing, Methodology, Measurement, Analytical techniques, Clays, Silts.

An electronic method was developed and compared to the pipet method for determining particle size distribution of 43 samples representing a wide

variety of Idaho soils. The Coulter Counter model TAII was used for the electronic method. Thirty-seven of the 43 samples had the same textural classification by both the electronic and pipet methods. There was significant correlation between the two methods in the amounts of clay and silt found in the soil samples. Approximately twice as many samples can be run by the electronic method in the same amount of time as by the pipet method. Sample concentrations were kept below 5% deflection of the concentration index meter, 2 to 4% being optimum. This allowed for minimum coincidence error while keeping counting time between 2 to 5 min for most samples. Filtering all water through a 0.45- and 0.22- micrometer filter system prior to preparing the electrolyte solutions, and filtering the electrolyte solutions through another 0.45- and 0.22 micrometer system prior to use, effectively eliminates background noise due to contamination. (Humphreys-ISWS)
W80-02862

8I. Fisheries Engineering

SUMMARY OF CENTRAL STATES FISHERY STATION STRIP MINE LAKE PROJECT REPORTS 1973-1978,
Fish and Wildlife Service, Princeton, IN. Central States Fishery Station.
R. S. Glesne, and C. J. Surprenant.
In: Surface Mining and Fish/Wildlife Needs in the Eastern United States, Report No FWS/OBS-78/81 A, p 123-125, 1979.

Descriptors: *Lake fisheries, *Fish management, *Strip mine lakes, Acidic water, Mine wastes, Fish establishment, Infrared radiation, Analytical techniques, Illinois, Iowa, Ohio, Fish food organisms, Zooplankton, Catfishes, Yellow perch, Minnows, Shiners,.

Progress in fisheries management of strip mine lakes in Illinois, Indiana, and Ohio is reported as summaries of six fishery station biologist reports. Illinois, Indiana, and Ohio have few natural lakes, however, they do have an estimated 26,000 acres of strip mine lakes that will produce an estimated 156,000 surface acres of lakes after reclamation. Strip mine lakes have unique physiochemical properties that make standard natural lake or reservoir management practices unapplicable to them, therefore new management practices must be developed. To investigate the suitability of mine waters for several species of fish five Indiana lakes were renovated. Data were collected on fish standing crop, growth, and population structure. Fish species included in the study were yellow perch, smallmouth bass, largemouth bass, bluegills, channel catfish, fathead minnows, and golden shiners. Three of the report summaries concern the fertilization of strip mine lakes. Four southern Indiana lakes were stocked with fish and fertilized. First year data from these lakes indicate little beneficial effects from the fertilization. However, other fertilization studies in other lakes reported more diversity and density of benthic organisms and improved growth of young largemouth bass. The use of color infra-red photography to determine strip mine lake water quality is also reported. Visual color differences were observed between acid and nonacid sites and various other water qualities could be detected by color differences. (Seigler-IPA)
W80-02811

9. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

THE MEANS AND ENDS OF PUBLIC PARTICIPATION,
Wisconsin Univ. Extension, Madison. Environmental Resources Unit.
L. L. Klessig.
In: Lake Restoration, Report No EPA 440/5-79-001, p 27-31, 1979, 5 Tab, 13 Ref.

Descriptors: *Wisconsin, *Water management(Applied), *Lakes, *Water districts, Lake stages, Water quality, Water pollution control, Watersheds(Basins), Education, Governments, Regional economics, Taxes.

Public participation by local property owners and local communities in lake management programs is an important factor in the success of a program. Education is an essential part of public participation, but education alone is not enough. Areas of needed public education on lake management include the lake ecosystem, potential for management success, and organizational options. Operating examples of organizational options are over 100 lake communities in Wisconsin that have formed lake districts. The districts give the public a voice in decisions on boundaries, functional jurisdictions, equity, and voting rights as they relate to lake management projects. Public participation techniques need to be designed so that they are appropriate to their function. Seven techniques utilized in the Wisconsin lake management programs are evaluated. A third important factor in public participation is the need for an appropriate degree of parochialism on the part of lake management professionals. A concern and understanding of self-interest is necessary to motivate the public. Use of this approach in Wisconsin lake management programs resulted in a reduced possibility of community conflict and distrust of the government and an increased potential for community pride, project support, and improved relations. (See also W80-02773) (Seigler-IPA)
W80-02778

9D. Grants, Contracts, and Research Act Allotments

ACHIEVING THE 1983 WATER QUALITY GOALS,
Environmental Protection Agency, Washington D.C. Water Planning Div.
S. T. Davis.
In: Lake Restoration, Report No EPA 440-5-79-001 p. 11-15, 1979.

Descriptors: *Federal Water Pollution Control Act, *Water quality control, *Government finance, Legislation, Water Quality Act, Water pollution, Waste treatment, Recreation, Swimming, Fishing, Discharge(Water), Lakes, Government supports, Planning, Management, Grants, Monitoring, Environmental Protection Agency, Governmental interrelations, State governments.

The Clean Act of 1972 identified the goals of eliminating pollunt discharges by 1985 establishing water quality levels sufficient for recreational activities and wildlife and fish protection. The Environmental Protection Agency (EPA) was aurorized to provide technical and financial assistance to aid in attaining these goals. However, the large number of programs and lack of coordination greatly showed the implementation process at the local level. Emphasis is now being placed on State/EPA agreements to facilitate the implementation of the various programs and funds. The Clean Water Act Amendments of 1977 are expected to encourage more small town use of construction grants for waste treatment systems by simplifying government requirements of the states and local areas. Beginning in 1980, State/EPA agreements will be expanded and will involve all of the programs under the Resource Conservation and Recovery Act and the Safe Drinking Water Act. It is hoped that States will begin to develop overall environmental planning and management programs instead of making small individual efforts. Program coordination efforts are suggested for: (1) data collection for population and wasteload projections for all programs, (2) monitoring efforts for all programs, (3) water quality assessments for both surface and ground-water resources, (4) effective facility planning, and (5) wasteload allocations. (See also W80-02773) (Seigler-IPA)
W80-02775

10. SCIENTIFIC AND TECHNICAL INFORMATION

10A. Acquisition And Processing

WESTERN COAL PLANNING ASSISTANCE PROJECT; SOURCE BOOK FOR WESTERN COAL/ENERGY DEVELOPMENT.
Mountain West Research, Inc., Billings, MT.
Missouri River Basin Commission; Resource and Land Investigations Program (USGS), January 1979. 263 p, 13 Fig, 4 Tab.

Descriptors: *Information retrieval, *Data collections, *Coal mines, *Montana, *North Dakota, *Wyoming, Future planning(Projected), Bibliographies, Documentation, Libraries, Publications, Reviews, Aerial photography, Forecasting, Energy, Long-term planning.

Sources of information on coal-energy development are presented to aid local planners and decision makers as part of the Planning Reference System developed by the Western Coal Planning Assistance Project (WCPAP). WCPAP is designed to aid State and local planners and decision makers in the development of technical methods and information required to cope with coal-energy development problems. The project involves major coal areas in Montana, North Dakota, and Wyoming. Information sources included are those for published and unpublished documents, library facilities and bibliographic retrieval systems, data files and information systems, maps and aerial photographs, technical assistance, and financial assistance. The sources given are designed as backup references for forecasts, facts, and methods presented in other parts of the WCPAP Planning Reference System. The focus of the sources is on the local concerns of coal-energy development. Sources were selected based on their quality, appropriateness, and currency. The sources are divided into two major groups, information/data sources and technical assistance and funding. Also, to assist system users an extensive glossary is provided. (Seigler-IPA)
W80-02713

10D. Specialized Information Center Services

DIRECTORY OF MEMBER ORGANIZATIONS OF THE NATIONAL WATER DATA EXCHANGE (NAWDEX),
Geological Survey, Reston, VA. Water Resources Div.
M. D. Edwards, and J. M. Nokes.
Geological Survey open-file report 79-1075 (supersedes open-file report 78-872), 1979. 50 p, Append.

Descriptors: *Information retrieval, *Data storage and retrieval, *Water resources, *Information exchange, *Organizations, Cooperatives, *National Water Data Exchange(NAWDEX), Directory, Member organizations.

The National Water Data Exchange (NAWDEX) is a national confederation of water-oriented organizations working together to improve access to water data. It consists of member organizations from all sectors of the water-data community. This Directory provides the names, addresses, and telephone numbers of all NAWDEX member organizations and their designated NAWDEX representatives. (Woodard-USGS)
W80-02934

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ABSTRACT SOURCES

SOURCE	ACCESSION NUMBER	TOTAL
A. CENTERS OF COMPETENCE		
Illinois State Water Survey, Hydrology	W80-02728, 02853 02862, 02867 02879--02896 02898--02911 02913--02916	40
University of North Carolina, Metropolitan Water Resources Planning and Management	W80-02846--02852 02854--02861 02863--02866 02868--02878	30
B. STATE WATER RESOURCES RESEARCH INSTITUTES	W80-02703--02709 02761--02763	10
C. OTHER		
Environment Canada (WATDOC)	W80-02832--02845	14
Environmental Information Services, Inc. (Effects of Pollutants on Aquatic Life)	W80-02937--02978 02980--02993	56
Information Planning Associates, Inc.	W80-02712--02727 02729--02760 02764--02770 02772--02831 02994--02996 02998--03000	121
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Office of Water Research and Technology	W80-02710--02711	2
U. S. Geological Survey	W80-02918--02936	19

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Subject Fields

1 NATURE OF WATER

2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

6 WATER RESOURCES PLANNING

7 RESOURCES DATA

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9 MANPOWER, GRANTS, AND FACILITIES

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